ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

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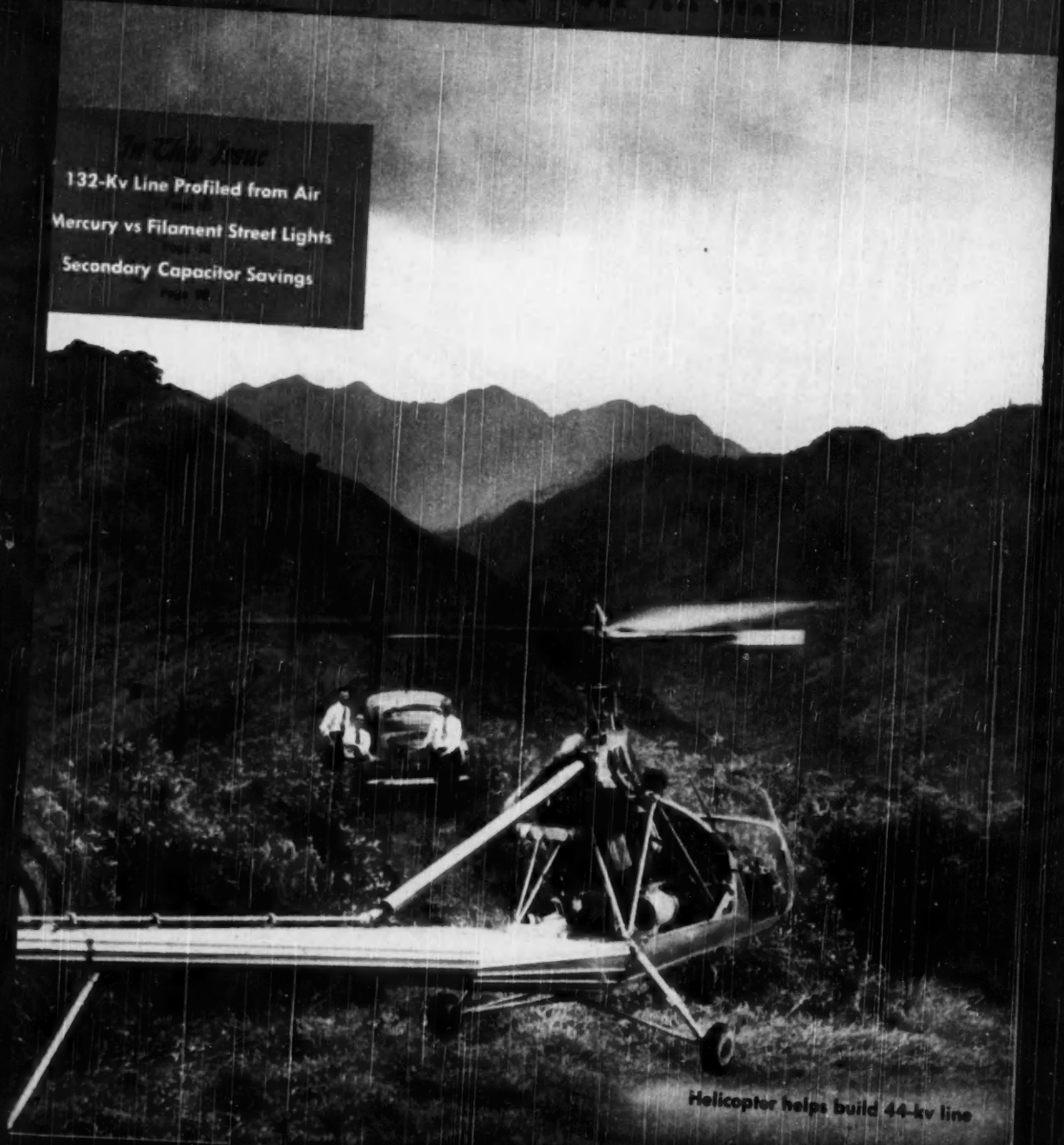
132-Kv Line Profiled from Air
Mercury vs Filament Street Lights
Secondary Capacitor Savings



Helicopter helps build 44-kv line

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with Fully Magnetic Circuit Breakers

that are Interchangeable with Other New Single Pole Individually Housed Breakers

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These compact new Murray load centers are available in 2, 6 or 8 circuit models. They come equipped with the sensational new *small* size Murray fully magnetic circuit breakers — now 30 per cent smaller than previous fully magnetic circuit breakers — available in ratings of 10 through 50 amp. They save you time . . . save you trouble . . . save you money — yet assure the user positive protection combined with utmost satisfaction!

Shallower Box — only 3 inches deep—ideal for flush installation in "dry wall" construction. Plus a simple ⅛" plaster line adjustment!

See for yourself why Murray fully magnetic breakers can't trip from heat . . . never need derating . . . always carry rated load plus harmless overloads—even in warm locations and poorly ventilated panels. Clear, simple diagrams tell the story in this folder. Write for your copy today.

Murray MANUFACTURING CORPORATION

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Electrical Safety Devices for Home and Industry

Of Personal Interest

If your job is concerned in any way with a steam plant, you'll find the year's two most important articles in the next two regular issues of Electrical World. The first one is the Sixth Steam Station Cost Survey, coming April 24. This year's survey concentrates exclusively on new plants and its highly informative data was supplied by 40 plants, 26 of them new, and 14 with separate new additions.

Knowlton

The second steam story, coming May 8, is "Distinctive Design Characteristics of 80 Post-war Power Plants." The sub-head on this article says "Compilation and analysis of over 200 details shows trends incorporated to thwart high construction costs, improve thermal performance, minimize operating staffs, focus the controls, all without sacrifice of reliability." In other words, this story gets right down to the $64 question: How to design plants for minimum investment in construction and operation with maximum efficiency.

Both articles are by Arch Knowlton and both contain information available nowhere else. Three good reasons why Arch is able to assemble the complex data he needs: 1) He has a wide personal acquaintance among top utility executives. 2) They gladly trust him to protect their anonymity. 3) They find the completed information so useful they willingly contribute to it. Arch Knowlton is walking proof of the old adage about giving a job to a busy man if you want it well done. He was general chairman of the AIEE's 1949 and 1950 winter general meetings in N. Y. and works on three more of the Institute's committees, besides belonging to ASME, NACE and CIGRE. For 12 years he has been editor in chief of the Standard Handbook for Electrical Engineers. He is chief advice-giver to Electrical World advertising salesmen and on week-ends he's baby-sitter to his grandson in New Haven. All in addition to what most people consider a very full-time job as Senior Associate Editor of Electrical World.

Cordially,
THE EDITORS

ELECTRICAL WORLD

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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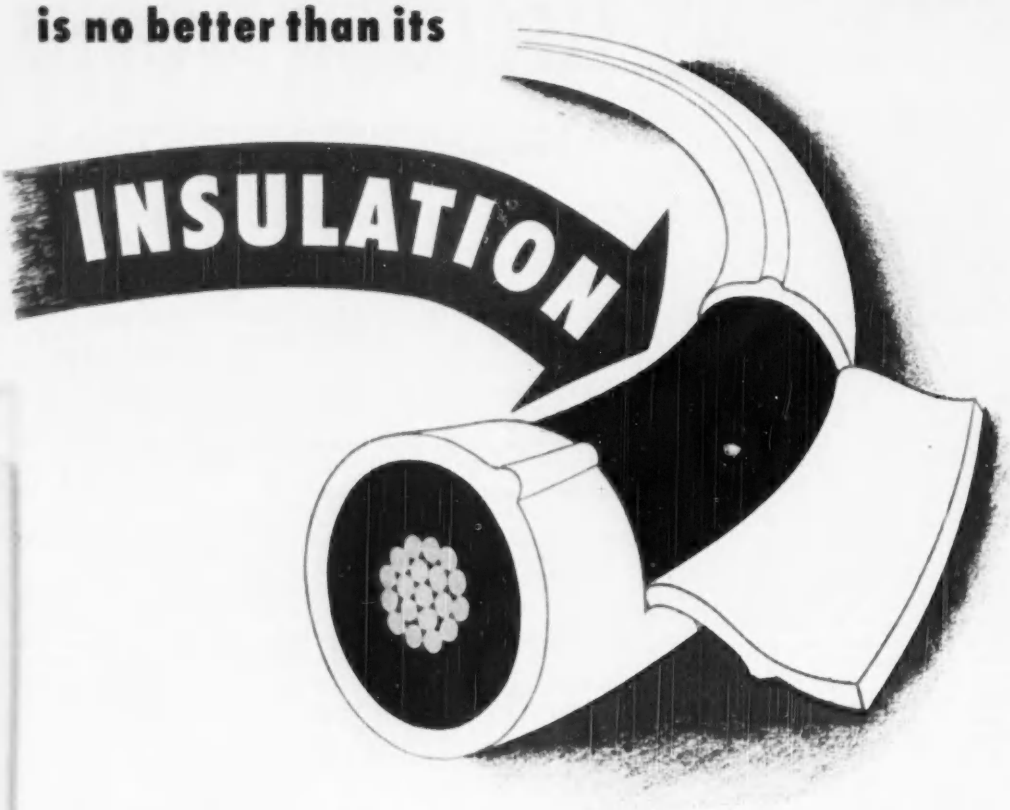
an electrical cable is no better than its



An electrical cable is only as efficient and long-lasting as its insulation. You will find true cable economy *only* in the cable with the best insulation. Because electrical insulation is so vital to cable performance, it is important to know what makes one type of insulation better than another.

There are three basic factors determining the electrical and mechanical characteristics of rubber cable insulation. 1. The type and grade of rubber used in the compound. 2. The method of applying the insulation to the cable. 3. The method of vulcanizing the insulation.

In Okonite insulations, each of these three points is a reason for superior performance. First, Okonite uses only Wild Up-River Fine Para rubber – the very finest obtainable – because this rubber has proved during more than 70 years of actual use to have better dielectric and aging qualities than any other.

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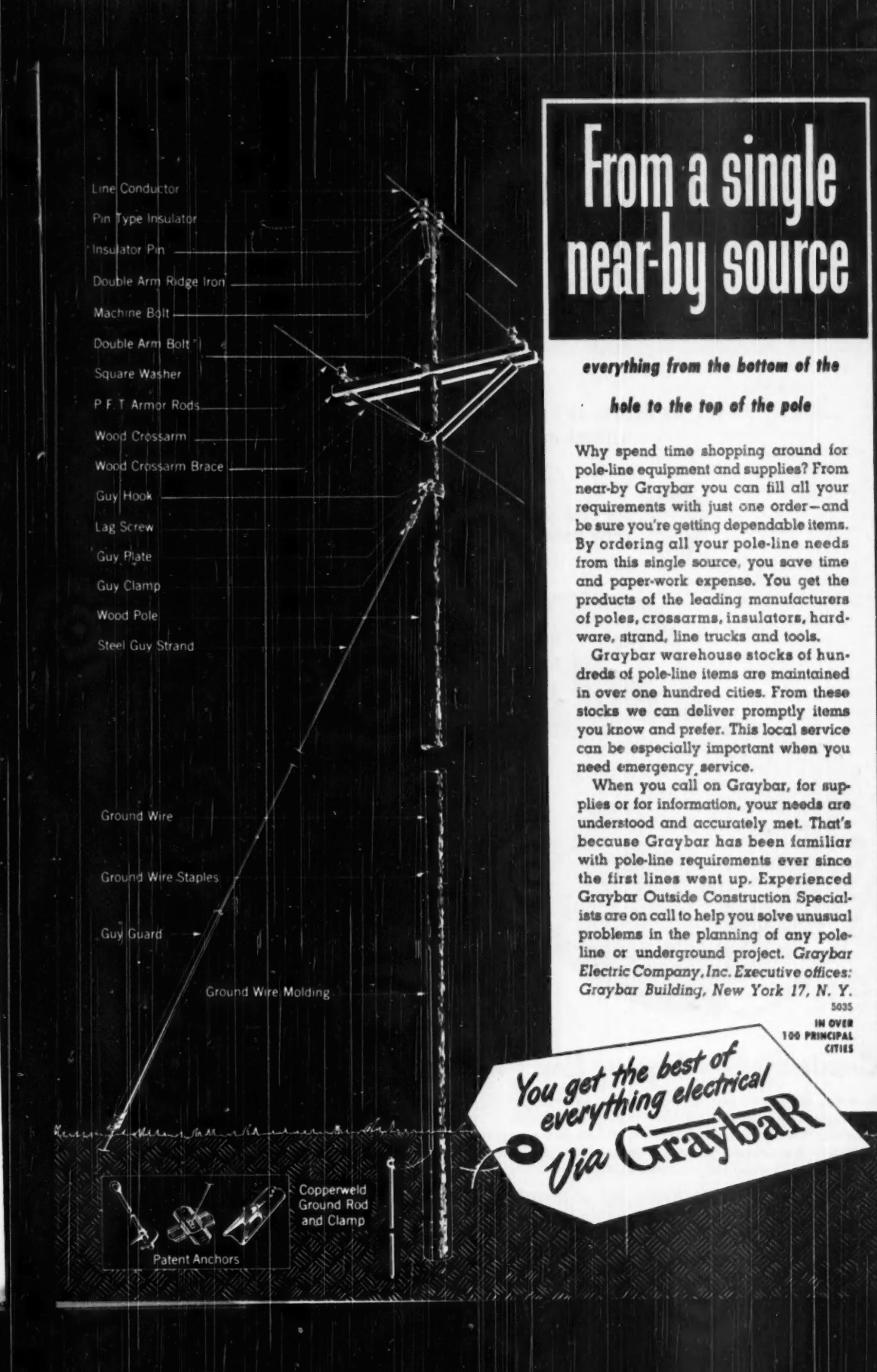

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Graybar warehouse stocks of hundreds of pole-line items are maintained in over one hundred cities. From these stocks we can deliver promptly items you know and prefer. This local service can be especially important when you need emergency service.

When you call on Graybar, for supplies or for information, your needs are understood and accurately met. That's because Graybar has been familiar with pole-line requirements ever since the first lines went up. Experienced Graybar Outside Construction Specialists are on call to help you solve unusual problems in the planning of any pole-line or underground project. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.*

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HOW IT WORKS:

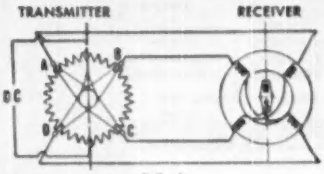

FIG. 1

D.C. voltage is applied to the transmitter resistance bridge at fixed points 180° apart. Roller brushes A, B, C, and D are mechanically positioned 90° from each other and can be rotated on the resistance bridge to change their position relative to the D.C. taps. These roller brushes are connected to receiver windings as shown in diagram 1.

The receiver rotor, being a permanent magnet, aligns itself with the center-line of the resultant stator poles. These resultant poles depend on the amount and direction of current flowing through the receiver stator coils. The current in turn depends upon the relative distance the transmitter rotating taps are from the fixed D.C. taps.

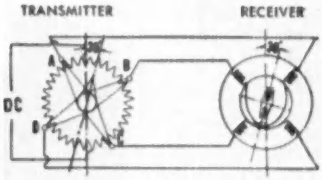

FIG. 2

Rotating transmitter taps A, B, C, and D 30° clockwise (fig. 2) rotates the receiver resultant poles 30° and causes a 30° clockwise rotation of the permanent magnet armature. In a like manner, any degree of rotation of the transmitter taps will be accurately indicated by the receiver.

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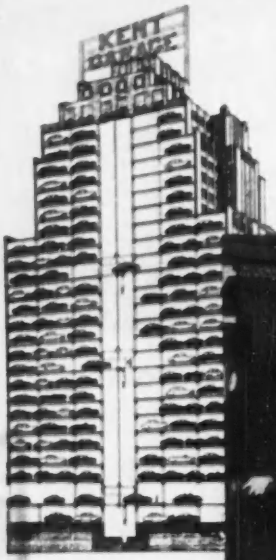
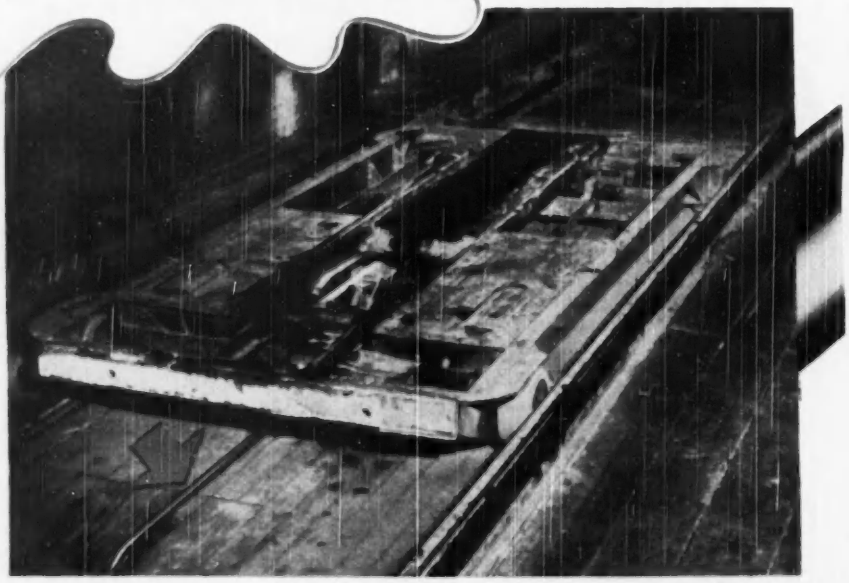
Cars parked...



Cars are parked twenty-three high in this electric parking garage—and they are never touched by human hands until the owner gets back in.

Electrical parking device powered through flexible AMERCLAD CABLE moves cars on and off elevators.

Electric parker installed in elevator rolls out under car, contacts the differential housing and pulls car back into elevator. Operator handles all controls from elevator.



Note the rubber-covered flexible Amerclad Cable that powers the three parker motors. This cable gets constant flexing over the pulley, must stand abrasion and oil droppings.

untouched by human hands

IN KENT ELECTRIC PARKING GARAGES

• At last you can have your car parked in a big city and get it back quickly without dents in the fenders.

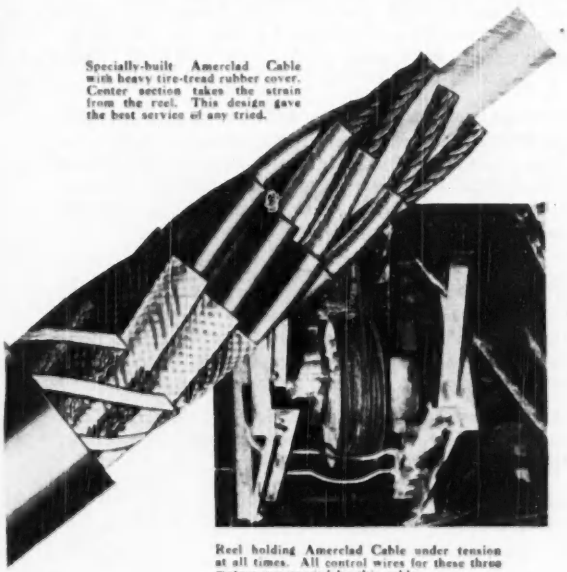
The man who did something about the big city parking situation was Mr. Milton A. Kent from the small town of Kenosha, Wisconsin. He designed an electric parking garage based on the idea that the garage must be near the motorists' destination, quick and safe in handling cars, reasonable in price, and of good architectural design. Four of these garages are already operating in Chicago, Cincinnati and New York.

How they work

The heart of the idea is an electric parking machine used in combination with a high-speed automatic landing elevator. The motorist drives up in front of the elevator door, leaves his car in neutral with the brake off. The elevator operator sends the electric parker out under the automobile, raises a platform which bears against the car's differential and rolls the car onto the elevator without lifting it. The process is reversed in parking the car. At no time is the car driven by the attendant.

U·S·S Amerclad Electric Cable

SUPPLIES POWER TO ELECTRIC PARKER



Specially-built Amerclad Cable with heavy tire-tread rubber cover. Center section takes the strain from the reel. This design gave the best service of any tried.

Reel holding Amerclad Cable under tension at all times. All control wires for these three motors are carried by this cable.

THE electric parker is a low four-wheel machine driven by electric motors. It scoots out from the elevator like a spider, grabs a car and hauls it back in.

A flexible Amerclad Cable on a reel supplies power to the parker. This cable takes a terrific beating. It is dragged over the concrete floor, picks up oil and is constantly reeled and unreeled over a small pulley. Various cables were tried and Amerclad was finally chosen because it gave the best service for the least cost.

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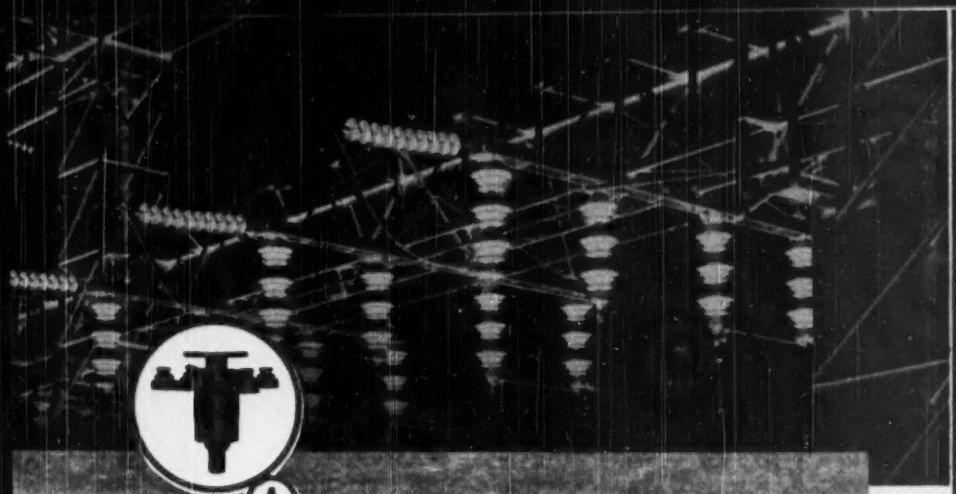

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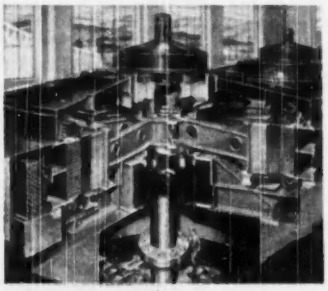

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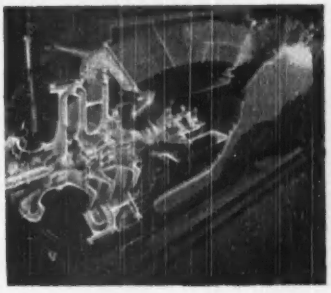

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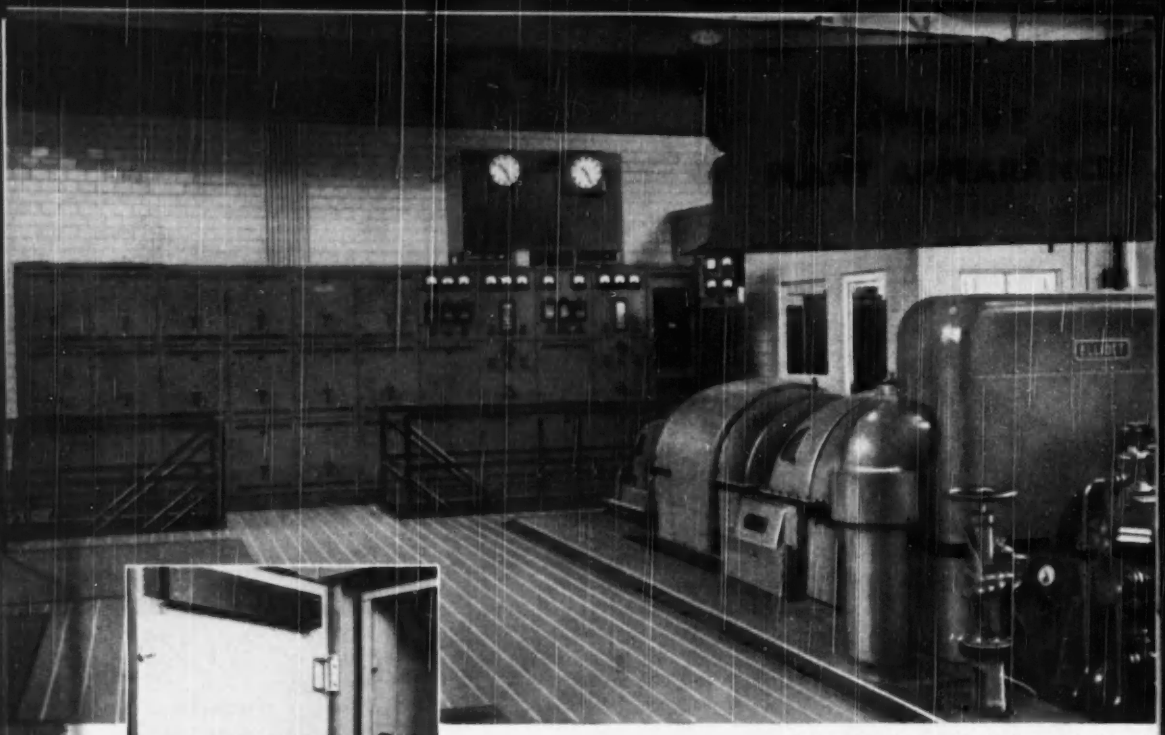
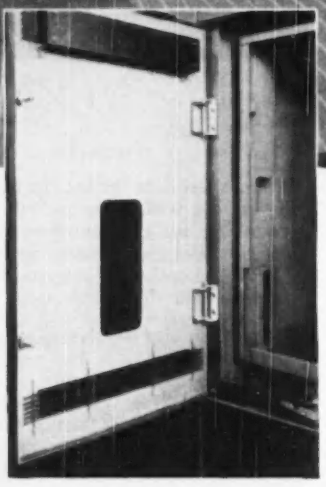
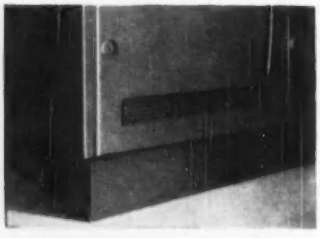


Photograph — Courtesy Falls City Brewing Co., Louisville



All panels and doors are full-formed sheet steel. Corners are turned and welded for greater rigidity. All hinges are concealed by being mounted *inside* the enclosure. Effective grilled louvers contribute to the smooth, neat appearance of the switchboard.



Practical and attractive sturdy channel base can be bolted to the floor, or it can be inset either part-way or flush with the floor surface. Formed top trim and end panels complete the elimination of dangerous and unsightly raw metal edges.

MULTUMITE SWITCHGEAR IS ATTRACTIVE!

Note the compactness and beauty in the construction of the typical Multumite assembly above. With the exception of the breaker-operating handles and the semi-flush instruments, the exterior of the board presents a flat surface from top to base. All parts of the enclosure are full-formed from sheet steel—there are no raw metal edges. Grilled louvers and easy-to-adjust door hinges are hidden inside, adding to the pleasing appearance of the board.

The exterior finish of Multumite switchgear is an oven-baked synthetic enamel—bonderized to the metal to guarantee a permanently attractive surface.

GET THESE DESCRIPTIVE BULLETINS:

6003-D A complete reference guide to I-T-E 600 V Switchgear assemblies. Contains dimension information on I-T-E Multumite, and helpful facts for specifying and ordering complete switchgear installations.

7000-A Describes I-T-E's newest 5 KV Switchgear—is illustrated and supplemented with practical, easy-to-read drawings and diagrams. If you have any questions on modern HV switchgear construction, it will pay you to have this bulletin.

Get both bulletins—ask your local I-T-E Representative, or write I-T-E General Offices.

get Extra Protection— SPECIFY I-T-E MULTUMITE SWITCHGEAR!

I-T-E Multumite Switchgear is specially designed to provide the *extra margin of safety* so necessary to uninterrupted service of electrical circuits. Metal-enclosed Multumite Switchgear assures positive protection of secondary distribution systems. *Here are some reasons why:*

1. Breaker's metal panel separates bus and breaker compartment, seals off ionized gases.

2. Silver-plated buses and connections eliminate progressive oxidization, minimize temperature rise.

3. Easy accessibility of breakers and bus compartments facilitates inspection and maintenance.

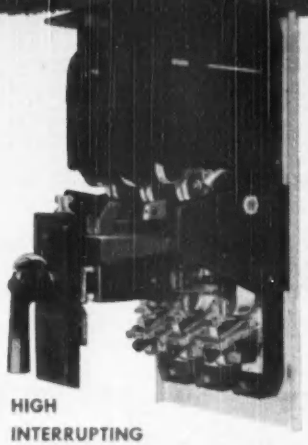
4. Enclosure of control wiring in metal troughs provides a new degree of safety and protection.

5. Specially designed arc chutes quench arcs *quickly* and dependably, *in air.*

6. Breakers are mechanically and electrically trip-free.

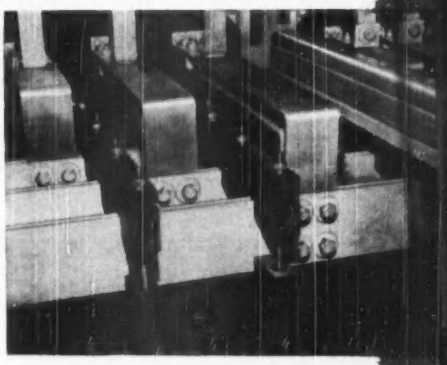
These examples of extra quality—extra protection built into I-T-E Switchgear are typical. Investigate the others.

All I-T-E Switchgear assemblies offer the benefits of an application planned for your specific needs, with units coordinated for most effective protection. Quick, easy installation is assured. *Complete* assembly is tested *before* shipment. Quality is fully guaranteed.



HIGH INTERRUPTING CAPACITY BREAKERS

TYPE KB Breaker. 25,000 RMS Amp. Interrupting Rating. 600 Amp. Continuous Rating. 2, 3, or 4 Poles. Manually or electrically operated.



IDEAL BUS ARRANGEMENT

MULTUMITE BUS is arranged for adequate electrical clearance. Strong bracing with sturdy insulating supports assures withstanding maximum short circuit stresses. Bolted connections provide solid contact and rigidity.

I-T-E R&IE

For *more dependable* Switchgear

specify I-T-E!

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

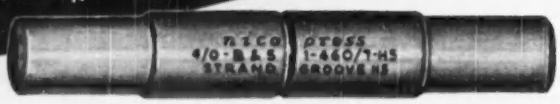
Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

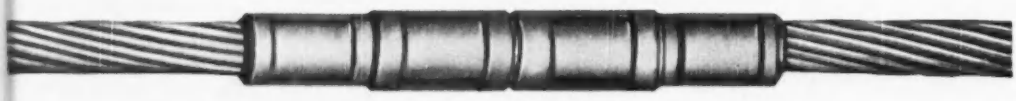
SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS
RESISTORS • SPECIAL PRODUCTS

Nicopress

FOR LARGE CONDUCTORS AND HIGH-STRENGTH STRANDS



**Light in weight—Holds full strength of conductor—
High in conductivity**



Completed NICOPRESS Splice on 4/0 Copper Conductor

**Completed NICOPRESS Splice on 3/8" Extra High Strength
Copperweld Strand**

**Completed NICOPRESS Splice on 3/8" Extra High Strength
Galvanized Steel Strand**

Nicopress is the Registered Trade Mark of The National Telephone Supply Company

THE NATIONAL TELEPHONE SUPPLY COMPANY

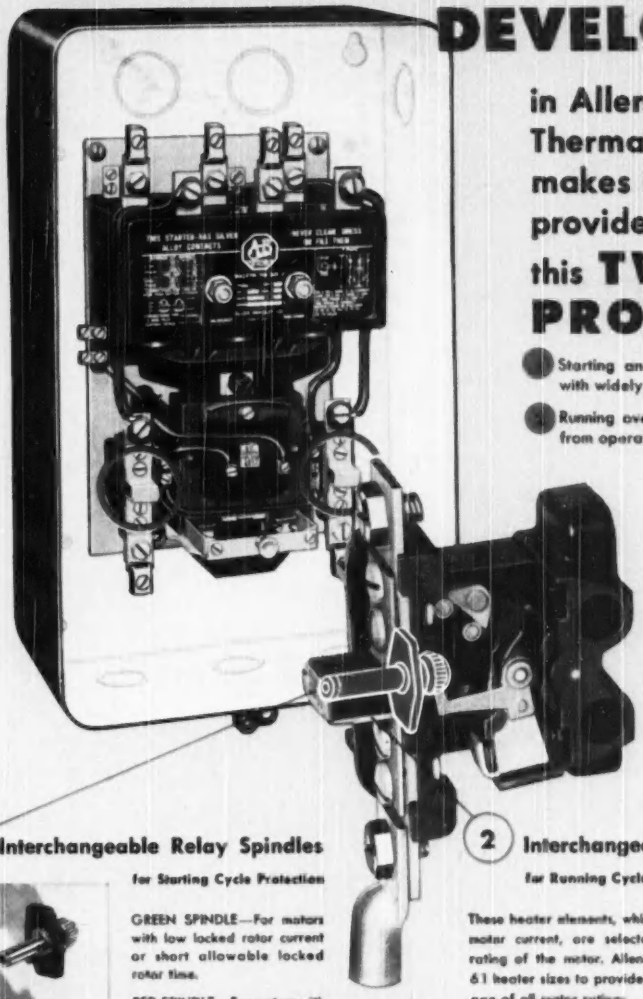
The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

A SPECTACULAR DEVELOPMENT

in Allen-Bradley Thermal Overload Relays makes it possible to provide your motors with this TWO WAY PROTECTION

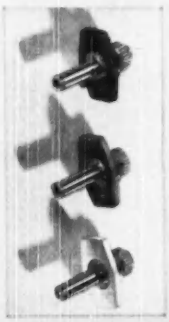
- Starting and locked rotor protection for motors with widely different characteristics.
- Running overcurrent protection to prevent motor from operating at damaging temperatures.



Now you can match your overload protection for motors under starting and locked rotor conditions as well as under running conditions. Allen-Bradley starters now have interchangeable overload relay spindles to provide various tripping characteristics. The proper spindle gives your motor locked rotor and starting protection. The proper heater element gives running protection. Unnecessary shutdowns will then be eliminated.

1 Interchangeable Relay Spindles

for Starting Cycle Protection



GREEN SPINDLE—For motors with low locked rotor current or short allowable locked rotor time.

RED SPINDLE—For motors with normal allowable locked rotor time and normal starting time.

TAN SPINDLE—For motors with normal allowable locked rotor time and long starting time. Ideal for flywheel and other high inertia loads.

Bulletin 815 Resisto Therm Overload Relay . . . the type used on most Allen-Bradley motor starters.

2 Interchangeable Heater Elements

for Running Cycle Protection

These heater elements, which carry the main motor current, are selected to match the rating of the motor. Allen-Bradley supplies 61 heater sizes to provide adequate coverage of all motor ratings.

These heaters, when used in conjunction with the three types of spindles illustrated at left, provide 183 combinations to match the characteristics of your motors.

That's why Allen-Bradley motor starters provide full motor protection.

ALLEN-BRADLEY

MOTOR CONTROL

QUALITY

A-B Quality

2-50-MB

(OVER)

HOW *Interchangeable Spindles and Heater Elements provide* TWO-WAY MOTOR PROTECTION on Allen-Bradley Starters

MOST overload relays protect motor windings during the running cycle. But, because motors and motor loads vary so much in character, an overload relay with a single characteristic is unable to provide full motor output and protection under starting and locked rotor conditions.

Now, Allen-Bradley offers *interchangeable* relay spindle assemblies in three types—red, green, or tan—which can be changed in the field from the front of the starter. Each has a different over-current tripping characteristic. The running rating of the relay, however, is determined solely by rating of heater element. Heater element provides full running cycle protection; relay spindle assembly provides full protection during starting cycle and locked rotor condition.

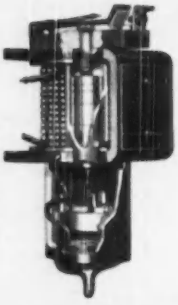
If you will give Allen-Bradley engineers complete information on your starting cycle, normal running current, frequency of starting, and ambient temperatures, they will supply the correct combination of heater unit and relay spindle assembly to fit your motor and load condition.

As a result, it will be possible to keep your motor running at a safe operating temperature during starting, running, and locked rotor conditions—adding years of motor life. Now you can work motors safely to full capacity—eliminating unnecessary, costly shutdowns. Write for full information.

OTHER ALLEN-BRADLEY OVERLOAD RELAYS

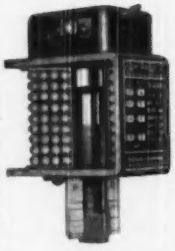
BULLETIN 810
DASHPOT TYPE
MAGNETIC OVERLOAD RELAY

Resets quickly after tripping. Ideal for woodworking and other equipment where motors frequently stall. Trip current and tripping times adjustable. Silicone dashpot fluid practically eliminates changes in tripping time with temperature.



BULLETIN 820
INDUCTO THERM
OVERLOAD RELAY

For accurate overload protection of slip ring and squirrel cage motors having normal allowable locked rotor times and locked rotor currents five or more times full load current. Tripping value easily adjusted over wide range.



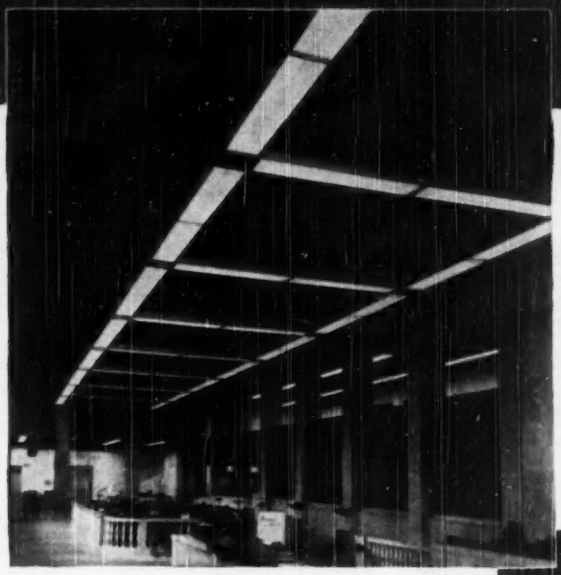
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

A-B Quality

2-50-MB

14½ TONS



Sturdy, adjustable Unistrut channel and fittings were used in this large midwestern bank to support, suspend and align 249 slimline fixtures and 20 spot lights. Here is how it was done: Unistrut channel attached to the ceiling and mounted on the fixtures was connected by hanger rods spaced on 18-ft. centers.

Result is a good looking, completely safe installation with all rows of units perfectly aligned and supported, fewer hangers and fittings required, and substantial time and money saved on the job. Photo below illustrates continuous fixture run suspended wholly by Unistrut framework attached to columns and walls.

Unistrut is metal channel with a continuous slot. You simply insert the Unistrut spring nut into the channel at approximate point where attachment of another framing member, hanger or fitting is desired, slide to exact position and bolt tightly in place. No drilling, no welding, no special tools or equipment required.

Try Unistrut on your next fluorescent lighting job—prove that it saves time, cuts costs—that it's fast and easy to install, no matter how difficult or complicated the job. Unistrut is trim framework, provides great strength without bulk and lasts indefinitely. You can support fluorescent fixtures *better* with Unistrut!

UNISTRUT

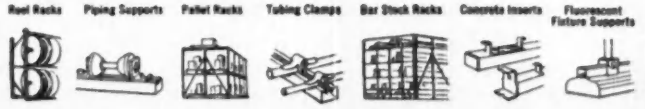
The World's Most Flexible All-Purpose Metal Framing

FULLY TESTED AND PROVED BY CONTRACTORS ON THOUSANDS OF INSTALLATIONS DEMANDING THE FINEST IN LIGHTING.

U. S. Patent Numbers
2377387 2379815 2345650
2363383 2380379 2405631
Other patents pending

Prompt Delivery from Warehouse Stocks in Principal Cities—consult your Telephone Directories

A few of the many uses of Unistrut



Write for your free copy of Unistrut Bulletin No. FF-3

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd.
Chicago 7, Ill. Dept. W-4

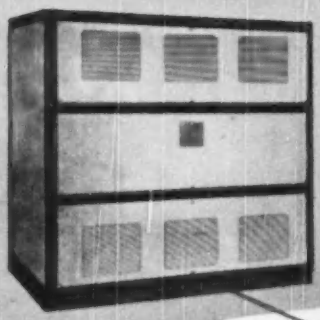
Please send me your Fluorescent Fixture Support Bulletin FF-3, without obligation.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

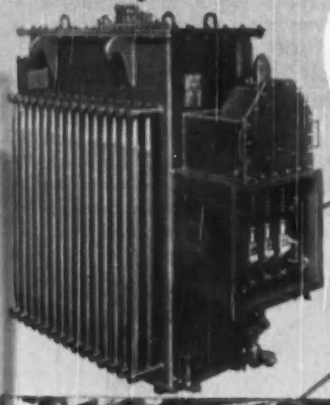


DRY TYPE
Natural and Forced Air Cooled

1000 KVA, 3 phase,
80°C. rise
Class B Insulation
4160Y—480 Δ volts

NETWORK
Submersible and Vault type

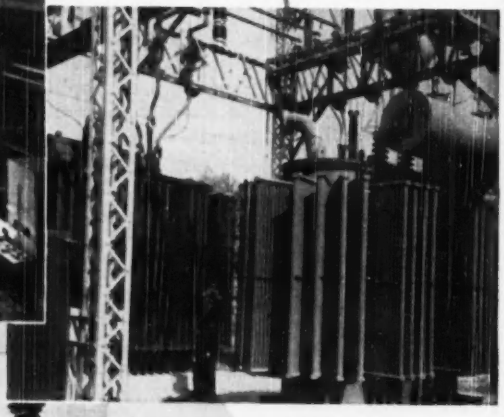
500 KVA,
3 phase,
60 cycles
7200/12,470Y-
208Y/120

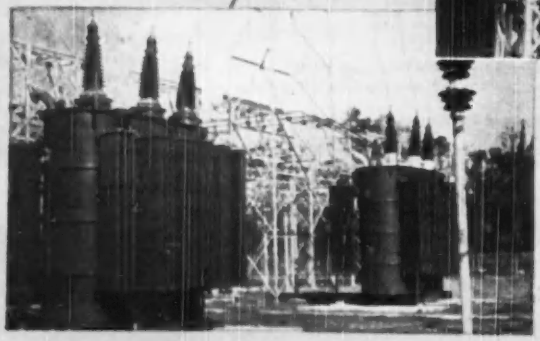


Pennsylvania TRANSFORMERS

The TRADE

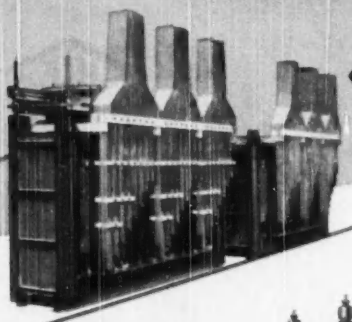
View of Main Assembly floor at Pennsylvania's modern plant in Canonsburg, Pennsylvania.





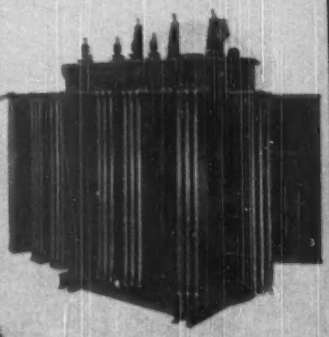
ONE 5000 KVA and ONE 7500 KVA, 3 phase, 60 cycles, OA. 33,000 Δ — 2400/4160Y volts.

TWO 7500 KVA Pennsylvania Transformers, 3 phase, 60 cycles, OA. 115,000Δ—13,800Y/8000 volts.



FURNACE
For operating Electric Arc Furnaces as large as 75 tons.

2—10,000 KVA, 3 phase, 60 cycles, OIWC.

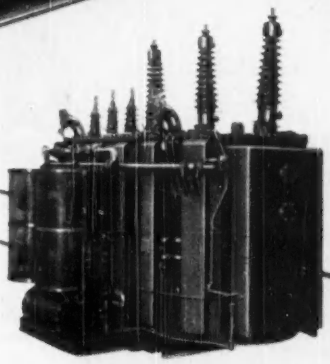


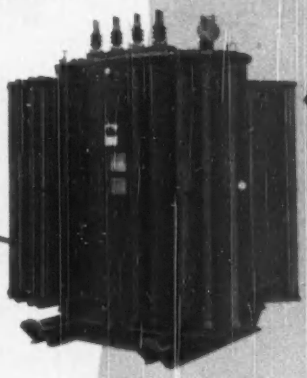
POWER
667 KVA to 50,000 KVA
Up to 230,000 volts.

Detachable Radiators
15,000 KVA, 3 phase, 69,400Y— 13800 Δ volts

LARGE POWER
Forced Oil Cooled

30,000 KVA, 3 phase, 132,000— 25,000 volts





STANDARD PARTS POWER
Up to 10,000 KVA
Up to 34.5 KV

3750 KVA, 3 phase, OA, 12,000 Δ — 4160Y volts

MARK that represents

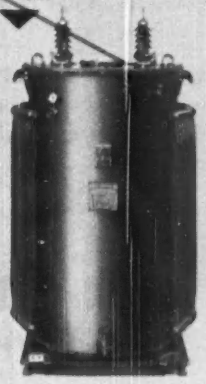
a distinguished product to the electrical world

Sound management, thorough knowledge of the product, and good workmanship is earning Pennsylvania Transformer Company an honored place in the Electrical World. Modern equipment and over ½ million square feet of efficiently arranged floor space enables Pennsylvania's 1100 men and women to concentrate on building good, reliable transformers. A special Planning Department, devoting all of its time to research and development work, promotes improvements such as those incorporated into Pennsylvania's Pole Star and Standard Parts Power Transformers.

TOMORROW, as TODAY, the Pennsylvania trade mark will continue to represent the finest in transformers.

DISTRIBUTION
3 KVA to 500 KVA
Up to 46,000 volts.

500 KVA, single phase, 60 cycles, OA 14,400—240x480 volts



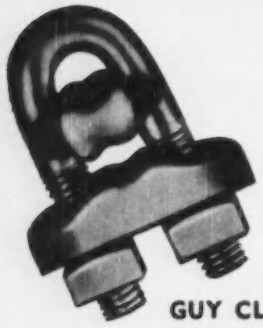
The POLE STAR

100 KVA and below 14,400 volts and below, conforming to E.E.I.-NEMA Standards

Pennsylvania
TRANSFORMER COMPANY
CANONSBURG, PENNSYLVANIA
Greater Pittsburgh District

We invite you to write for Pole Star Catalogs No. 349 and 1049. Also ask for Pennsylvania Standard Parts Power Transformer Booklet No. 1492.

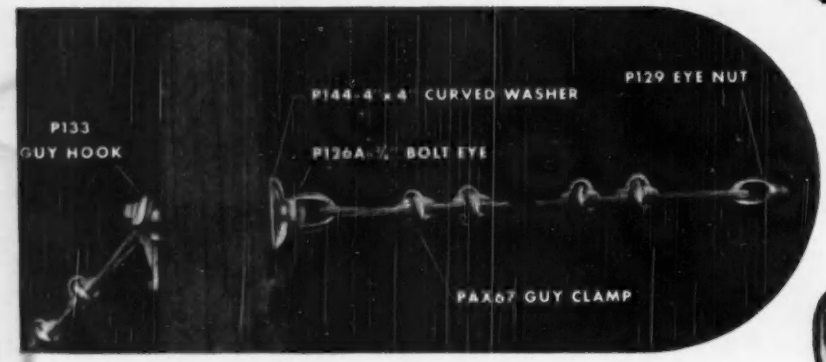
Pennsylvania's complete line of transformers includes: Askarel Transformers, Unit Substation Transformers, Portable Unit Substation Transformers, and Pipe Welding Transformers.



GUY CLAMPS

WASHERS

GUY HOOKS



EYE NUTS

BOLT EYES

GUY in Confidence

with M.I.F. "field tested" Guying Specialties!

Each M.I.F. Guy Hook, Guy Clamp, Washer, Bolt Eye and Eye Nut was developed by men who have climbed the poles, men who have first hand knowledge of the importance of dependable fittings.

Through bolt guying, pioneered by M.I.F., is now accepted as general practice. M.I.F. through bolt guying devices have no equal for economical installation, maintenance free operation and long service life

Write for descriptive literature.

MALLEABLE IRON FITTINGS CO.

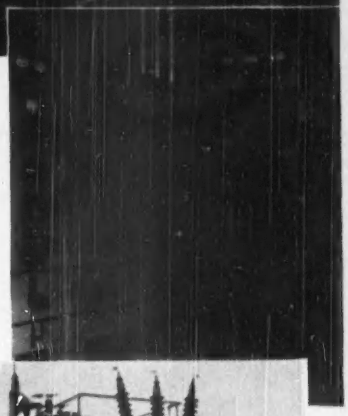
POLE HARDWARE DIVISION

Branford, Connecticut

N. Y. OFFICE: 30 Church St.

Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd., TORONTO

Representatives: South E. A. THORNWELL, INC., Atlanta, Ga. • MR. J. P. VOIGHT, Summerville, S. C. • WILLIAMS SALES AGENCY, Fort Myers, Fla. • Midwest BRUECK ENG. CO., Minneapolis 15, Minn. • JAMES H. DREW CORP., Indianapolis, Ind. • MINTEER & JOSLER, Chicago, Ill. • MR. D. C. WITTE, Detroit, Mich. • Pacific Coast WILLIAM J. COTTRELL CO., Portland, Ore. • INDUSTRIAL ENGINEERING & EQUIPMENT CORP., Los Angeles, Cal. • WALTHAM, DE WITT & KRUSI, San Francisco, Cal.



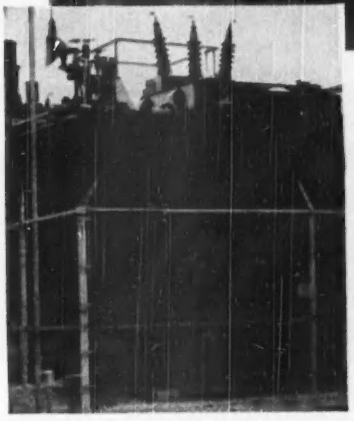
EXIDE-MANCHEX BATTERIES

assure positive switchgear operation at St. Louis, Prairie Substation of Union Electric Company of Missouri

In this modern substation, the 60-cell DME-11 Exide-Manchex installation is used for D.C. control circuits, including switchgear tripping and closing, and emergency lighting. Exide-Manchex Batteries were chosen for their well-known dependability, long life, low cost maintenance and many outstanding features which are equally important to you. They include . . .

- the famous manchester positive plate with its *exclusive* lead button construction.
- slotted plastic separators, impervious to chemical and electrical reaction.
- plastic spacers that maintain perfect plate alignment.
- the latest development in molded glass jars.
- heavy terminal posts with copper inserts for extra conductivity.

Combined, these Exide-Manchex features assure you dependable power for positive operation of switchgear . . . an adequate and uninterrupted supply of current for all your stationary storage battery requirements in central and substation service.



1888
DEPENDABLE BATTERIES FOR 62 YEARS
1950

"Exide" and "Manchex" *Reg. Trade-marks U. S. Pat. Off.*

THE ELECTRIC STORAGE BATTERY COMPANY • Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

Allis-Chalmers Experience Planning Industrial Distribution Systems!

CALLED IN EARLY on a food processor's expansion and modernization program, Allis-Chalmers engineers found that tremendously increased capacity was necessary. But additions to their 480 volt system were out of the question because short circuit capacity already exceeded the interrupting capacity of commercially available breakers. Economy and safety demanded a new distribution system.

On the basis of extensive experience with conversion problems of this type, Allis-Chalmers engineers made the following recommendations:

1. *Install a 12,000 volt primary distribution system to load centers.* This would reduce line losses; eliminate long, heavy copper bus runs, and improve voltage regulation.

2. *Use Dry-Type Load Center Unit Substations with primary selector switches.* This would permit feeding existing and new machinery from either a preferred or an emergency source, shorten low voltage runs, and give adequate short circuit protection from commercially available breakers of economical size.

This solution was so satisfactory that it has since been applied at two branch plants. This year alone 17 substations have been added to 37 previously installed in their plants . . . attesting not only to satisfaction with the system—but to satisfaction with Allis-Chalmers engineering service and equipment as well!

Call in A-C at the Basic Planning Stage

What Allis-Chalmers Unit Substation engineering is doing for others, it can do for you! And the time to call on this experience is during basic planning, early enough for sound equipment recommendations. An A-C representative is ready to go to work with you at your convenience. Get in touch with him at your nearby Sales Office, or write direct.

A-2939

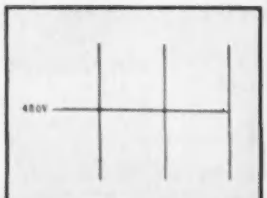
ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-

Pioneers in Load Ratio

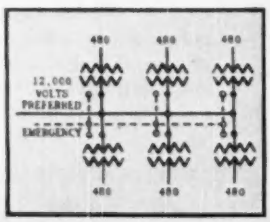
BEFORE

Before modernization the entire plant was on a single low voltage system. This meant excessive line losses, poor voltage regulation, and long runs of heavy copper to carry the required kva. The system was inadequate.



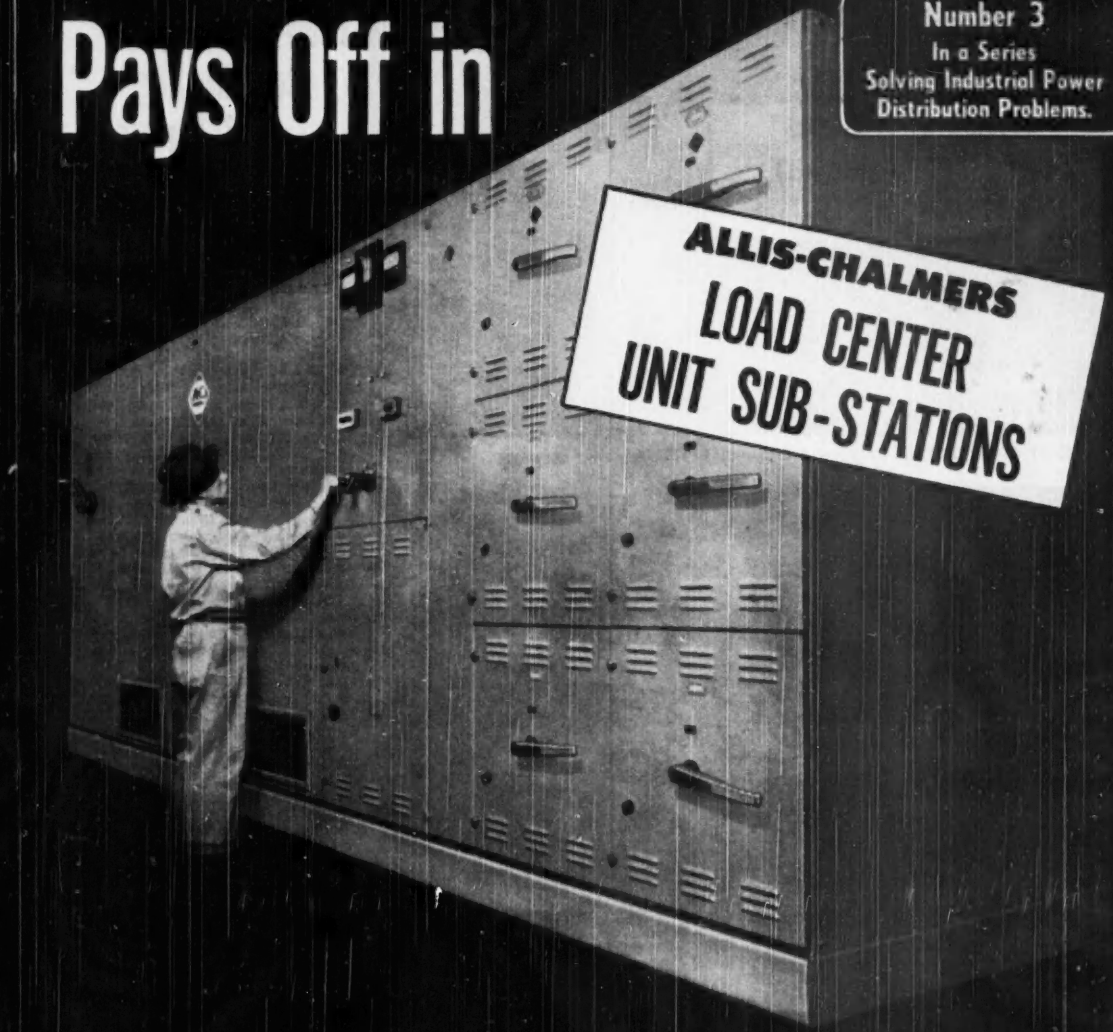
AFTER

Aftermodernizationa12,000 volt primary distribution system carried the required kva through lighter copper, cut line losses, improved voltage regulation, and had the added dependability of an emergency source.



Pays Off in

Number 3
In a Series
Solving Industrial Power
Distribution Problems.



CHALMERS

A-C ALLIS CHALMERS

Control — Originators of 5/8% Step Regulation

SAFETY & ECONOMY

Safety and economy resulted from the new set-up. Now economical 50,000 AIC feeder breakers provide adequate protection, a job no commercially available breaker could do on the original system. Results: safety, dependability and easier maintenance.

SEND FOR LITERATURE

Helpful Planning Literature: Bulletins: 11B6285A, "How Power at Load Centers Pays Off!"; 11B6325B, "Check List to Simplify Unit Substation Planning"; 11B6895, "Planning and Engineering Guide book for LCS Unit Substations."

ALLIS-CHALMERS PROGRESS REPORT TO ELECTRIC UTILITIES

43,800 HP ROLLING STEEL! Typical of A-C Power, Electrical, Processing equipment

Load-Building, Cost-Cutting A-C Products

H. A. Bartling
Mgr. Electronics

DURING THE PAST YEAR A-C advanced production not only in electric power equipment, but in actual electric load-building equipment as well.

MOTORS. New, protected general purpose motors in drip-proof and totally-enclosed types are now offered to industry in sizes from ½ through 20 hp. New tube-type TEFC and explosion-proof motors from 75 through several thousand hp have been marketed for powerhouse, chemical and petroleum needs. Improved maintenance, protection are stressed.

STARTERS. The line has been expanded to meet practically all requirements from the smallest manually-operated across-the-line starters to the largest high capacity units. You can now get an Allis-Chalmers starter for any size motor!

ELECTRONIC EQUIPMENT. Allis-Chalmers Induction and Dielectric Heaters, and Metal Detectors, widest line in industry, are helping users cut unit costs, improve products, protect quality.

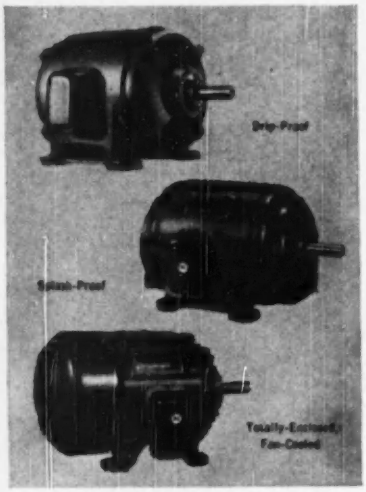
BETATRONS. A-C has opened the world's first commercial betatron laboratory, providing open time for high-speed radiography and research. Five 24,000,000 volt betatrons have been shipped for medical, and nuclear research.

NEW CAR SHAKER. Introduced for power plants and industries requiring fast unloading of frozen coal or other materials from hopper-bottom cars.

On the equipment side, utilizing electric power, emphasis has been on mechanization—more A-C crushers, hoists, screens, huge steel mill motors, shakeouts. In cement, A-C rotary kilns, long as 475', are electric-powered. A new petroleum pipe line will use 29 A-C tube-type motors. In public works, huge A-C pumps from 5 to 21 mgd, are being installed. In pulp and paper a total of 16,000 hp of motors, a 170' kiln and 46 pumps are going into one plant! These examples are typical.

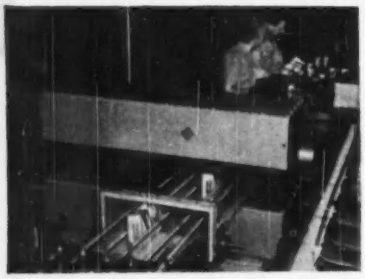
Building equipment for . . . and promoting applications of . . . *electric power* is the No. 1 job of the General Machinery Division of Allis-Chalmers! Over 65 years in electrical equipment, 102 years in industrial, are concrete evidence of Allis-Chalmers' stake in the Electric Power Industry! ALLIS-CHALMERS, 932A S. 70TH ST., MILWAUKEE 1, WIS. A2722

HIGH PRODUCTION 20-kw induction heater

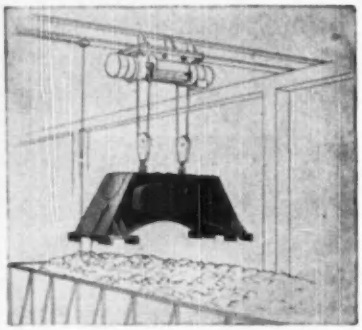


"SAFETY-CIRCLE" MOTORS—more protection

15-KW DIELECTRIC heater for wood-gluing



METAL-DETECTOR safeguards consumer products



ELECTRIC-POWERED car shaker loosens coal, etc.

Safety-Circle is an Allis-Chalmers Trademark

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment—Builders of the World's Widest Range of Major Industrial Equipment!

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

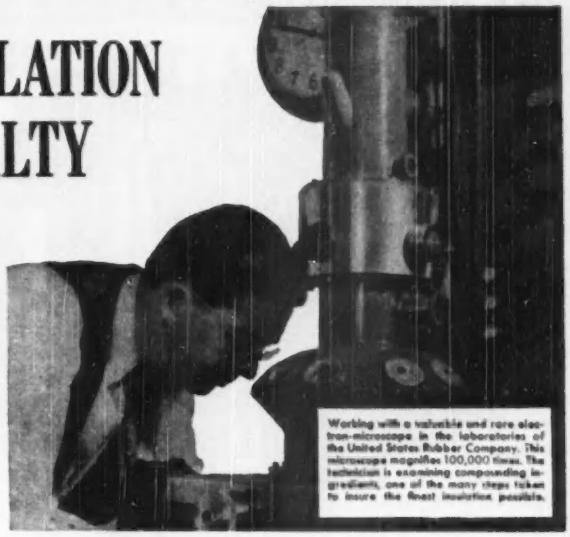
A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.



Working with a valuable and rare electron-microscope in the laboratories of the United States Rubber Company. This microscope magnifies 100,000 times. The technician is examining compounding ingredients, one of the many steps taken to insure the finest insulation possible.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables • Street Lighting • Royal Cords • Network Cables • Utility Control • Pole & Bracket Cable • Service Entrance • Weatherproof • Zip Cord Pole Fixture Cable • Sup. Control

RAILROADS: Power Cables • Communications • Railway Signal • Royal Cords • Welding Cable • Railway Utility • Sup. Control • Weatherproof

HEAVY INDUSTRY: Power Cable • Royal Cords • Welding Cables • Control Cables • Machine Tool Wire • Building Wire • Switchboard Wire • Thermostat Cable • Bus Drop Cable

ONE OF MANY SUPERIOR "U. S." WIRE AND CABLE PRODUCTS

USKORONA-NEOPRENE POWER CABLES

Ozone-resistant for high-voltage applications in wet or dry locations.

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 75 C. They will not crack after 3 hours in air containing .015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalis and corrosive chemicals. Uskorona-Neoprene cable also eliminates electrolysis. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Uskorona			Neoprene Jacket	
	Unaged	After 96 Hrs. O.B.	After 7 Day Geer Oven	Unaged	After 96 Hrs. O.B.
Tensile Lbs./Sq. In.	500	450	450	1800	1600
Elongation Per Cent	250	200	200	300	250

MOISTURE RESISTANCE (MAXIMUM VALUES)

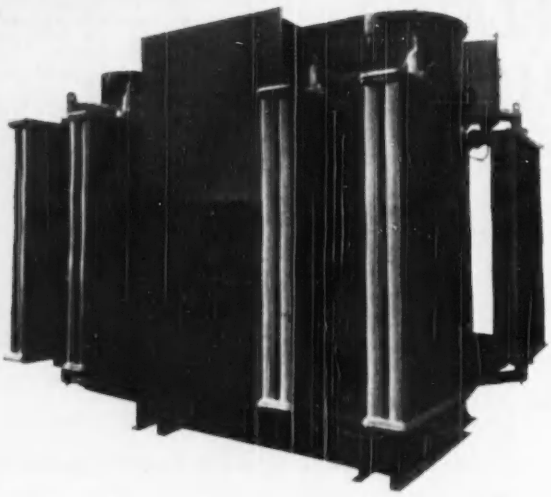
Dielectric Constant and Power Factor of the insulation after immersion in water at 50 C.: Dielectric Constant, one day is 4.5; per cent gain, 1 to 14 days is 5.0; per cent gain, 7 to 14 days is 2.0; Power Factor, per cent, one day is 3.0; Stability Factor 40-80 volts/mil two weeks, per cent is .5.

U.S.RUBBER
SERVING THROUGH SCIENCE

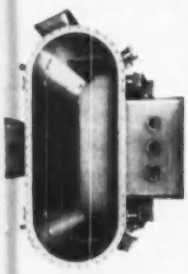
UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N.Y.

How KUHLMAN has YOU in mind in building Power Transformers

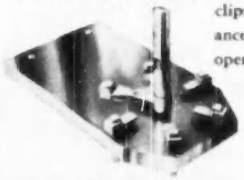


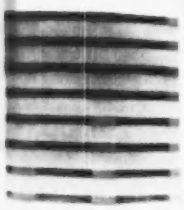
Kuhlman Power Transformers are not merely built — they are engineered! Kuhlman has had 55 years experience designing and building power transformers to meet the requirements of utility and industrial customers. These transformers have earned a high reputation for efficiency and reliability through the use of Kuhlman's proved and accepted design principles. Below is a revealing look inside a Kuhlman Power Transformer.



Rigid sturdy construction: Structural steel clamps hold the core securely — prevent shifting and vibration, provide support for coil braces, and center the transformer in the tank. The tank itself is made of heavy steel plate with all seams electrically welded and has a thoroughly protected surface. All bushing bosses and openings have smooth gasket surfaces and provision for external bolts.

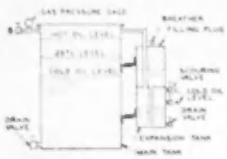
A typical result of the constant search by Kuhlman engineers for new materials, new designs, and new manufacturing methods is the new Kuhlman tap changer. This tap changer features high overload capacity at low temperature rise on contacts, low contact resistance, self-aligning spring clips on rotary blades, ample clearance at all points of voltage stress, operation by an external handle, and a plainly marked dial which assures locking handle in desired position with the handle locked by pin.





Thorough Protection: Kuhlman coils below 25 KV are assembled, dried under heat and vacuum, immersed in a thermo-setting, polymerizing-type varnish, and then baked. For voltages above 25 KV, varnish treatment is replaced by oil impregnation under vacuum. Kuhlman maintains a complete testing laboratory equipped to make every conceivable test on power transformers in accordance with E.E.I. NEMA standards.

More detailed information on Kuhlman Power Transformers may be had by writing for the new Bulletin CS-601. Kuhlman also manufactures a complete line of Distribution, Dry Type, Street Lighting, and Specialty Transformers. Bulletins on any type of Kuhlman Transformer are available on request.



Gas-oil-seal tanks are standard on transformers above 2000 KVA, voltages above 46 KV and optional on other ratings at no extra cost. In this system, an auxiliary tank is divided into two compartments containing oil and allowing expansion and contraction of the gas in the transformer tank under all conditions of loading and temperature.

EXPERIENCE COUNTS — THIS IS OUR 56TH YEAR

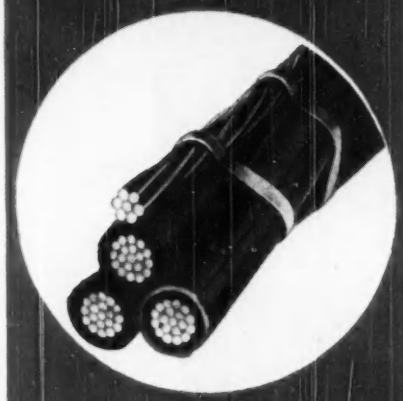
Kuhlman

KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN

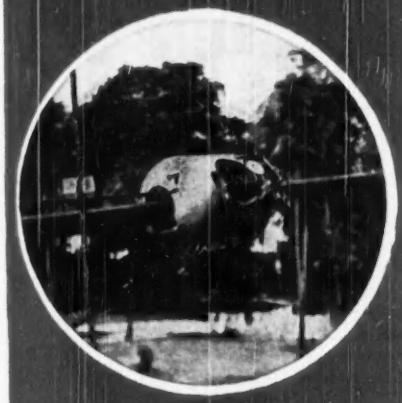
EXPORT REPRESENTATIVES: *International Standard Electric Corporation,* **67 Broad Street, New York 4, N.Y. Cable Address, Microphone, N.Y.**

SIMPLEX-ANHYDREX AERIAL CABLES

KEEP OVERHEAD DISTRIBUTION COSTS AT DOWN-TO-EARTH LEVELS



Self-Supporting Type
Stored at the Factory to Support the Messenger



Installing Cables by Spinner Method

SIMPLEX
WIRES & CABLES
SIMPLEX WIRE & CABLE CO.
79 Sidney Street
CAMBRIDGE 39, MASS.

Wherever the installation, whatever the service conditions, Simplex-ANHYDREX Aerial Cables provide a sure-fire means of cutting the cost and improving the performance of overhead distribution systems.

Anhydrex insulated, neoprene jacketed, and designed for installation by either the self-supporting or spinner methods, they furnish a wealth of advantages over open wire lines — advantages that mean uninterrupted service year in and year out plus big savings on installation and maintenance. Some are listed below, but there are many others you'll want to know about. All are described in the Simplex Aerial Cable Catalog which we will gladly send to you upon request. Simply fill in and mail the coupon below.

ADVANTAGES FOR INSTALLATION

- Less labor needed to install
- Can be installed on existing pole lines
- Crossarms not needed
- More circuits per pole
- Low congestion on poles; phases and neutral assembled together
- Little or no tree-trimming required
- Smaller clearances needed
- Unrestricted cable routing
- Attractive appearance

OPERATING ADVANTAGES

- Better regulation
- Anhydrex insulation has high dielectric strength, low power factor and low dielectric constant
- ANHYDREX is unexcelled for resistance to moisture
- Neoprene jacket provides protection against oil, chemicals, fungus, heat and sunlight
- Neoprene resists abrasion by swaying limbs and chafing against poles
- Fewer service interruptions due to winds, icing, and lightning
- Not subject to corrosion
- Higher safety factor for people and property below
- Less maintenance required

SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

When you think of Electric Heat

think of

Hoskins Chromel*

You're living in a world of taken-for-granted "miracles." Load building miracles . . . like the ingenious new electric irons, the wonder-working electric ranges, the automatic electric hot water heaters. Not to mention the countless other electrical heating devices that have become common accepted "necessities" of life. And the most amazing part of it is that, although their usefulness is based entirely upon electric heat, seldom today does a buyer ask, "How long will the heating element last?"

There's a good reason for this unquestioning faith in heating elements . . . a basic reason that is directly responsible for the successful development of your residential, commercial, and industrial heating loads. And that reason is the fine durability and the consistent quality of HOSKINS CHROMEL resistance alloy.

For CHROMEL, you know, is the *original* nickel-chromium alloy that *first* made electrical heating practical. It's highly resistant to oxidation, possesses close-to-constant "hot" resistance between 700° and 2000° F., delivers full-rated power throughout its long and useful life. And it's backed by over 40 years specialized research, manufacturing, and application experience devoted exclusively to the interests of more and better use of dependable electric heat.

Our Catalog M-1 contains helpful information for your Load Building Department . . . want a copy?

HOSKINS MANUFACTURING COMPANY

4445 LAWTON AVE. • DETROIT 8, MICHIGAN

NEW YORK • CLEVELAND • CHICAGO

West Coast Representatives in Seattle, San Francisco, Los Angeles
In Canada: Walker Metal Products, Ltd., Walkerville, Ontario

*the original nickel-chromium resistance alloy that first made electrical heating practical

YOU CAN BE **SURE**... IF IT'S

Westinghouse

A New 100-AMPERE Type GR Recloser...

For Rural and Suburban Distribution

- **100 amperes—continuous current rating**
- **2,000-2,500 amperes—interrupting rating**
- **Full 15-kv insulation (110-kv impulse withstand)**
- **Interrupts 2,000 amperes with full 15 kv across one pole**
- **Heavy top casting and deep-drawn tank—both heavily hot-dip galvanized**
- **One fast, and three time-delay openings, or four time-delay openings**
- **Bushings, mechanism, hangers—all interchangeable with 50-ampere series**
- **Five coil sizes available—25, 35, 50, 70, 100**

The 100-ampere GR Recloser is available for immediate delivery now. Use it to provide complete, economical protection for your rural *and suburban* lines. For complete information, ask your Westinghouse representative or distributor for Bulletin B-4339, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60721

WESTINGHOUSE

GR RECLOSERS

Doesn't preformed strand cost a lot more?

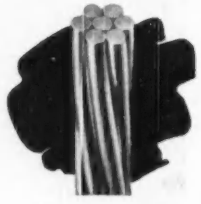
Not Bethlehem Form-Set. You pay hardly anything extra.

Buyers are often surprised at the moderate cost of Bethlehem Form-Set strand. It's preformed, yet costs so *little* more than ordinary strand—the non-preformed kind. The extra charge is almost nothing.

For a trifle more the user gains substantial advantages. Form-Set strand is easier to handle, easier to insert in fittings. The wires, through preforming, have been relieved of internal tension; hence, when cut, they all lie quietly in place. There's no explosiveness, no "bushing out" at the ends.

Try this test yourself. Using a sharp instrument, cut cleanly through an unseized length of Form-Set strand. To make the test even more convincing, use the high-strength or extra-high-strength grade. You'll find that the strand doesn't unravel or tend to loosen up. Each and every wire stays snugly in position, even at the spot where the cut has been made.

This means a lot to your linemen. Saves them time, assures a better job. For full details, ask a Bethlehem man to call.



The wires of Form-Set strand are protected against corrosion by the bethanized coating—an armor of highly-pure zinc applied electrolytically. This coating is available in three different weights.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

PROTECTION TODAY

L-M
GROUNDING HARDWARE
adds impulse strength on 34.5—46 kv lines

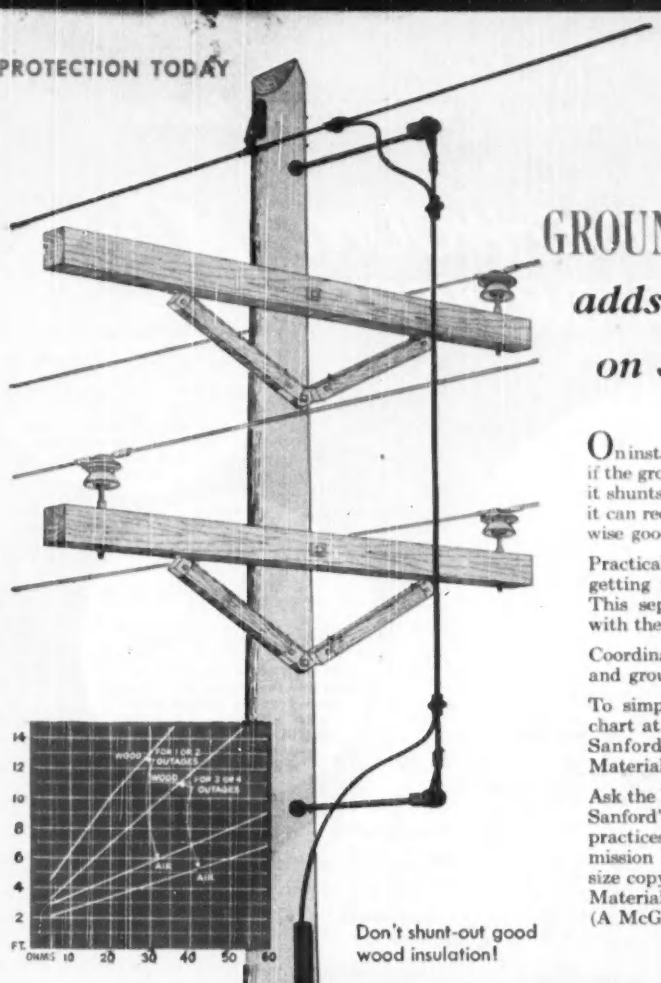
On installations using overhead ground wires, if the grounding down-lead is installed so that it shunts out the wood insulation of the pole, it can reduce or nullify the value of an otherwise good pole-top assembly.

Practical experience has shown the value of getting the down-lead away from the pole. This separation can be made economically with the L-M hardware shown below.

Coordination of wood and air gap dimensions and grounding resistance is the formula.

To simplify the calculation, the estimating chart at the left was developed by Frank E. Sanford as Consulting Engineer for Line Material.

Ask the L-M Field Engineer for a copy of Mr. Sanford's report of a nationwide survey of practices, together with a folder on the transmission hardware items required and a large size copy of the Sanford chart. Or write Line Material Company, Milwaukee 1, Wisconsin (A McGraw Electric Company division).



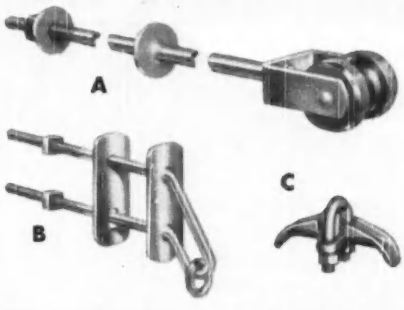
Don't shunt-out good wood insulation!

Sanford Estimating Chart for determining minimum air and wood paths for any measured ground resistance. A large size copy is available from L-M.

Some L-M Grounding Equipment for 34.5—46 kv lines

Here are a few of L-M's many transmission and distribution line construction materials. These are steel, hot-dip galvanized by L-M's modern quality-control methods. All bolts have buffer points to make them easy to drive.

SOME L-M GROUNDING EQUIPMENT FOR 34.5—46 kv LINES



(A) Extended Type Bracket for neutral wire down-lead. Pole-mounted as shown in illustration above. Lengths from 3'2" to 4'6".

(B) Loop Bolt for pole top hanging of overhead ground wires. Lengths 11½" and 13½" for pole diameters up to 10".

(C) L-M Suspension Clamp. Forged steel, heavily galvanized. Hangs from the Loop Bolt to hold the overhead ground wire.

7759

LINE MATERIAL

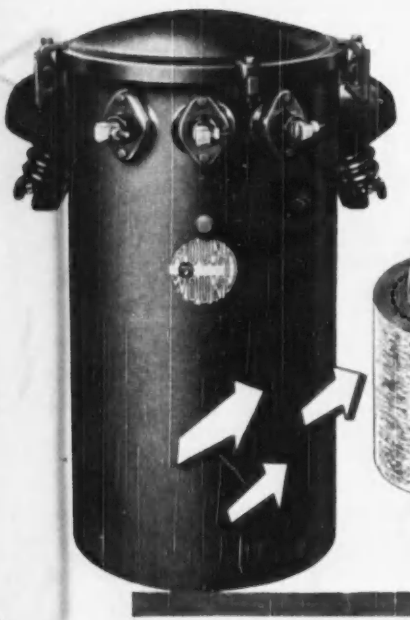
Line Construction Materials

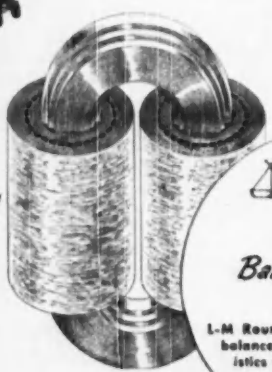
Complete Coordinated Equipment for Distribution Today

Cut failures... cut costs... with these features

of

L-M ROUND-WOUND TRANSFORMERS





High Short-Time Overload Capacity

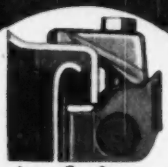
Stepped core cross section provides all passages between core and coil; these and the long round coils expose more surface to the oil, assuring better cooling.

High Impulse Strength

Coils are wound *round* right onto the core—no need to mallet coils into shape. Round coils can be wound tighter with better insulation distribution and improved impregnation, assuring higher average impulse strength.

Balanced Performance

L-M Round-Wound design provides balanced performance characteristics with their many advantages including better regulation, and high short circuit strength.



Quality Craftsmanship

Sealed tank construction, an L-M "first", is one of many quality construction features that assure long life for L-M Round-Wound transformers.

L-M Round-Wound transformers have a record of remarkably few failures—from all causes including lightning. This fact, together with their low operating cost, makes Round-Wounds a most desirable investment for both new construction and replacement of old, high-cost equipment. Want more information? Ask the L-M Field Engineer or write Line Material Co., Transformer Divisi[illegible]

LINE MATERIAL... TRANSFORMERS

Complete [illegible] Requirements

YOU MAKE THESE 3 SAVINGS WITH L-M 3-phase Transformers

1. INSTALLATION:

It's simpler to hang and wire one 3-phase transformer than a bank of three single-phase units—and it's safer, too!

2. POLE SPACE:

L-M sizes through 112½ kva can be bolted directly to the pole. You eliminate additional cross arms and get greatly improved appearance.

3. OPERATING COST:

The impedances of all three units in a 3-phase transformer are identical. This eliminates the circulating currents and losses in operation which may occur in banks of three single phase units.

Perhaps you, like many others, would like more information on the relative advantages of 3-phase transformers and single-phase banks. If you care to drop your problem in our lap, we'll be glad to work with you. Ask the L-M Field Engineer, or write Transformer Division, Line Material Co., Zanesville, Ohio (A McGraw Electric Company division).

Three core-coil units mounted in one rigid frame, for best cooling and maximum accessibility. Any one of the three units may easily be removed and replaced if necessary.

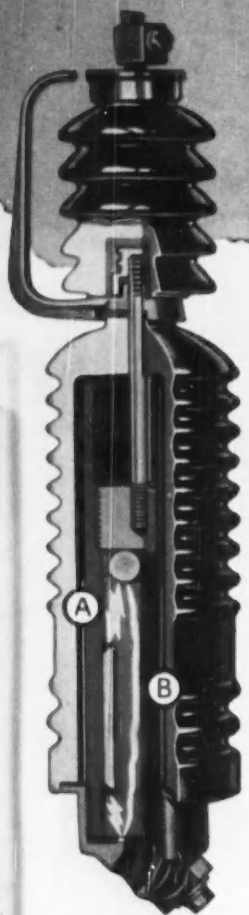
Ratings from 9 to 150 kva have famous L-M "Round-Wound" construction with its many advantages. Ratings from 225 to 500 kva have *round* coils on a three-legged stacked core; these offer many advantages not inherent in square-coil construction. For data and dimensions write for Bulletin DT5.

7590

LINE MATERIAL ... Transformers

Complete Coordinated Equipment for Distribution Today

L-M ANNOUNCES NEW LOW SPARKOVER LEVELS



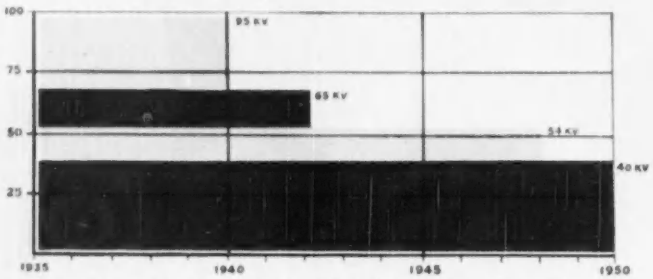
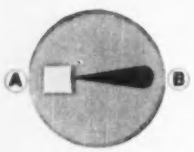


Chart shows reductions in critical impulse sparkover of 9 kv expulsion arresters. Successive improvements give L-M Expulsion Arresters the lowest impulse sparkover in history, the longest life in service.



Cross section of arcing chamber

outstanding improvements achieved by L-M Surge Laboratory research, development

● The extremely low sparkover recently achieved by L-M research answers one of the big objections to the use of Expulsion Arresters. With the new low sparkover voltages, these L-M arresters now give greatly increased protection throughout range of ratings.

Arrester life has also been substantially increased, by means of the L-M arc switching principle. Two electrodes are provided, in the narrow side of a wedge-shaped fibre arcing chamber. Jumping the short gaps at **A**, the arc forms gas that forces it into a long thin arc at **B**—and then almost instantly it is blown completely out of the chamber. The arc does not remain long enough to burn the electrodes and is extinguished so rapidly there is no appreciable erosion of the fibre.

No limit to system capacity on which this expulsion arrester may be used. Meets the NEMA-standard 65,000 amp discharge test with an ample safety margin. Available in 3, 6, 9, 12 and 15 kv sizes, with flat or cross arm mounting hangers. Wet process porcelain housing with rain-shed umbrella design. Strong clamp-type terminals. Heavy external gap electrode, eliminates accidental bending and changing of external gap spacing.

WHO DUNIT... AND WHAT!

Here's a thriller for those interested in expulsion arresters—the story of lightning arrester development and performance of the L-M PF-3 Expulsion Arrester. Ask the L-M Field Engineer for a copy of Bulletin LA3, or write Line Material, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

7487

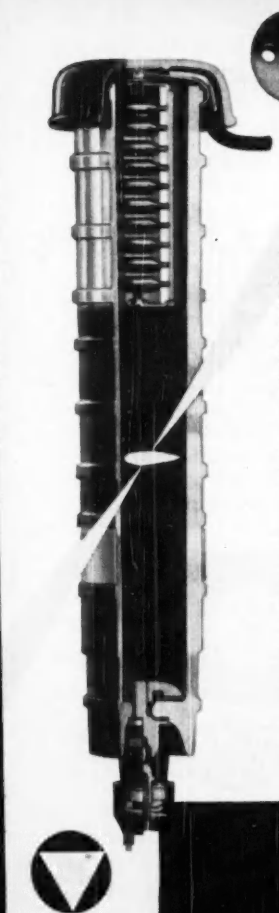
LINE MATERIAL Lightning Arresters

Complete Coordinated Equipment for Distribution Today

PROTECTION TODAY

LENS

for a lightning arrester



Here is how L-M Valve Type Arresters counteract "skin effect," and why L-M's "Granulon" characteristic element has such high discharge capacity and unchanging characteristics.

Lightning follows the path of least resistance—electrically. Also, like 60-cycle current in a conductor, it tends to "skin" down the outside of the valve element. In a lightning arrester, when the resistances down the middle and side of the valve element are the same, the surge invariably tends to channel down the outer edges.

The result? Repeated surges lower the discharge capacity, and in time the arrester clinkers, and fails. Usually nobody knows why, and attributes the failure to a direct stroke.

In L-M's "Granulon" characteristic element, *lens-shaped metallic electrodes* shorten the electrical distance down the center just enough to counteract the skin effect. The surge discharges evenly all through the "Granulon"—and the arrester lasts far longer.

The arrester can take *more* heavy surges . . . it maintains its high discharge capacity without change for years and years . . . rate of failure is gratifyingly low.

(Incidentally, that is why L-M is the only manufacturer who *dares* to put his arrester into a Pyrex® glass housing. You can *see* any signs of failure—which is so rare in L-M arresters we don't mind taking the cat out of the bag!)

Other features: precision gap, maintains low sparkover and fast action on both long low and steep front waves . . . draws negligible follow current—permits accurate fuse coordination . . . The Isolator, L-M's patent insurance feature—the arrester can never ground feeders. In all distribution voltages . . . Meets NEMA Standards and more!

GET THIS BOOKLET—JUDGE FOR YOURSELF

Ask the L-M Field Engineer for a copy of Bulletin LA1, or write Line Material Company, Milwaukee 1, Wisconsin (A McGraw Electric Company Division)

7488

LINE MATERIAL Lightning Arresters

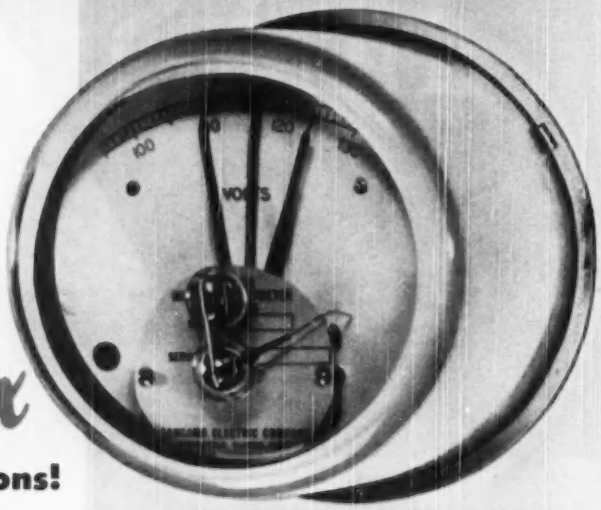
Complete Coordinated Equipment for Distribution Today

Distribution and Operating Engineers...

Reduce your voltage survey costs with low-cost, permanent

MiniMax

Voltmeter Installations!



Lincoln Type V-2S Indicating Voltmeter

You save money two ways by using the new MiniMax Indicating Voltmeter. It makes the use of graphic meters unnecessary in most cases, resulting in appreciable savings in meter investment; and when permanently installed, it saves the heavy labor cost of periodic surveys.

The Lincoln Type V-2S MiniMax voltmeter, time-lagged so that instantaneous values caused by sporadic conditions are not shown, is equipped with a maximum and a minimum voltage indicator on either side of a pusher pointer which is fixed to the actuating element of the meter. The pusher pointer spreads the indicators apart with changes in voltage. These indicators show the 10-minute averages of minimum and maximum voltages which have occurred since the last resetting. The pusher pointer shows the average voltage at any time.

Maximum return from existing distribution equipment results from systematically applied voltage control. Simple changes in the distribution system, such as transferring loads between transformers, changing transformer taps, balancing loads, resectionalizing, and adding transformers and regulators—often result in greater kilowatthour consumption and increased revenues. For the most effective results—at the lowest cost—make these changes on the basis of continuous voltage information provided by permanently installed MiniMax voltmeters.

Type V-2S MiniMax voltmeter, shown at left, can be installed in a standard meter socket, outdoors. Meter scales are available for voltage ranges of 95 to 135 volts, or 190 to 270 volts. The graphic form—Type CCV, at right provides a continuous *record* of average voltage. Bulletin 483 gives full information.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SO Oil Resistant...

IT'S UL Approved*

That's why TEMFLEX 105 Plastic Tubing excels in transformer duty

This tubing hits a new high in retained flexibility and elongation. Tested in oils at 90°C. for 60 days, TEMFLEX 105 shows absolutely no change in flexibility . . . no cracking or checking whatever . . . no loss in elongation. Stands up, too, under overload tests.

You won't have to worry about dielectric strength – it actually increases after 60 days in oil at 90°C. The U.L. tests demonstrating this also show that TEMFLEX 105 does not corrode conductors, or increase in thickness after aging. And it's permanently identified with the printing of TEMFLEX 105 along the entire length.

Be Sure To Send For U.L. Report

Check the complete report and see for yourself how TEMFLEX 105 surpasses any tubing you can buy for transformer service. Generous samples and full data will be sent promptly on request. Write.

*The only plastic tubing approved by Underwriters' Laboratories for use in high-temperature mineral oil.

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IRVINGTON INSULATION

IRVINGTON
Varnish & Insulator Company
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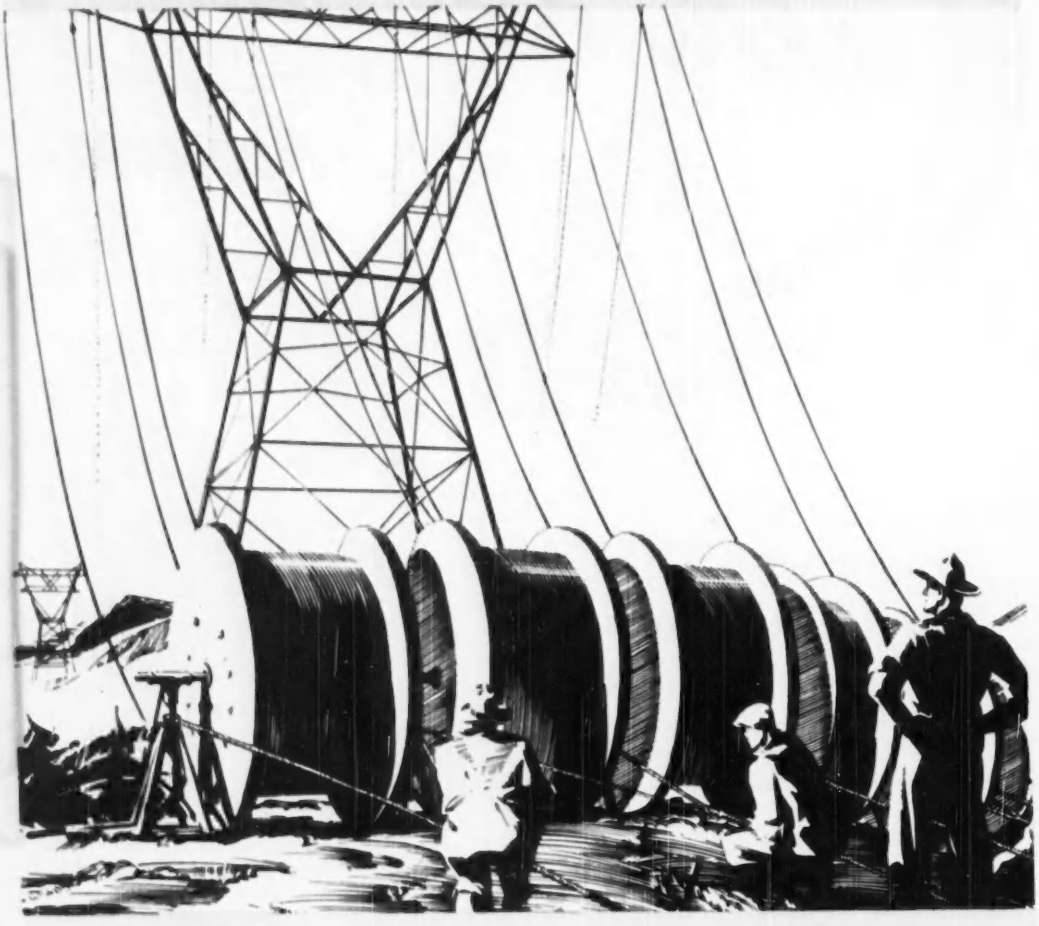
2 million miles of ACSR...



ALCOA FIRST IN ALUMINUM

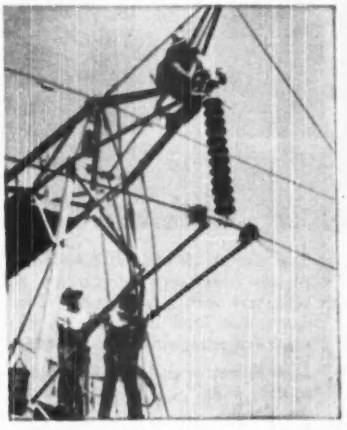
but what do they mean to you?

They mean that you get more than just cable when you buy from Alcoa—that you're tapping the world's greatest store of knowledge of ACSR problems. Think of this:

Alcoa made the first ACSR. Did the research that made possible mile-long spans. Developed the installation methods that made them practical. And today, Alcoa, with the momentum gained in this experience, is pushing forward to more knowledge of conductor problems.

That constant search promises better service from your transmission lines, lower maintenance. It's your assurance that you're buying ACSR from those who can best help you solve your conductor problems. ALUMINUM COMPANY OF AMERICA, 1924D Gulf Building, Pittsburgh 19, Pennsylvania.

TYPICAL of Alcoa research is armor rodding—now commonplace—developed 25 years ago to prolong the life of overhead conductors. Alcoa Armor Rods reinforce cable in the vital few inches of greatest stress, dampen vibration, prevent fatigue rupture of strands. They are also used to repair conductors which have previously suffered damage from vibration, burning or abrasion. Write for your free copy of the new Alcoa booklet on this subject to Aluminum Company of America, 1924D Gulf Bldg., Pittsburgh 19, Penna.



Installing Alcoa Armor Rods with hot-line tools on a 220,000-volt line without interrupting service.

FOREMOST IN A·C·S·R

Universally *Used* and *Recognized*

The six 24" *Walworth* Double Disc Gate Valves shown above are typical of the thousands of various types (Gate, Globe, Butterfly, Plug, etc.) equipped with *LimiTorque Valve Operators*—in daily use throughout the world—on land and sea. So, when we say that *LimiTorque* is *universally used and recognized*, we are making no "overstatement."

LimiTorque operates by the "push of a button," from either remote or nearby control panel . . . prevents damage to stem, seat, disc, gate or plug, because the Torque Seating Switch *limits the torque, and thereby, shuts-off the motor, before trouble can occur. LimiTorque* also *saves money and promotes safety.*

LimiTorque Controls may be obtained through Valve Manufacturers.

Send for 96-page illustrated and diagrammatic catalog.

Photo courtesy Walworth Company, Inc.

Philadelphia Gear Works, INC.

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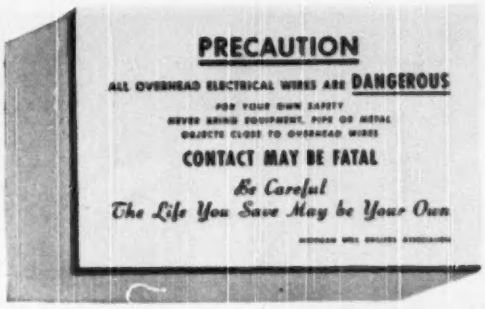
Industrial Gears and Speed Reducers
LimiTorque Valve Controls


PRECAUTION
ALL OVERHEAD ELECTRICAL WIRES ARE DANGEROUS
FOR YOUR OWN SAFETY
NEVER BRING EQUIPMENT, PIPE OR METAL
OBJECTS CLOSE TO OVERHEAD WIRES
CONTACT MAY BE FATAL
Be Careful
The Life You Save May be Your Own

These Graphic LAMICOID® signs, made for Consumers Power Company, Jackson, Mich., stay clear and bright despite rain and sun, heat and cold.

For clarity and permanence they "signed up" the right material...

Graphic Lamicoid

Consumers Power Company wanted warning signs that could be seen clearly. Signs that would keep their brilliant colors. Signs that would resist weathering and industrial fumes. So they specified Graphic LAMICOID.

This rigid, tough, moisture-resistant panel has printed matter permanently laminated in the thermosetting plastic sheet. The black-on-yellow printing—most visible color combination known—is protected by a surface of special age-resisting resins. Smooth and hard, it resists wear, won't check or cloud, does not readily pick up dirt, and can be wiped clean with a damp cloth.

Graphic LAMICOID needs no frames, no glass, and can be drilled, tapped, punched or sawed. These features make it unusually easy and economical to install.

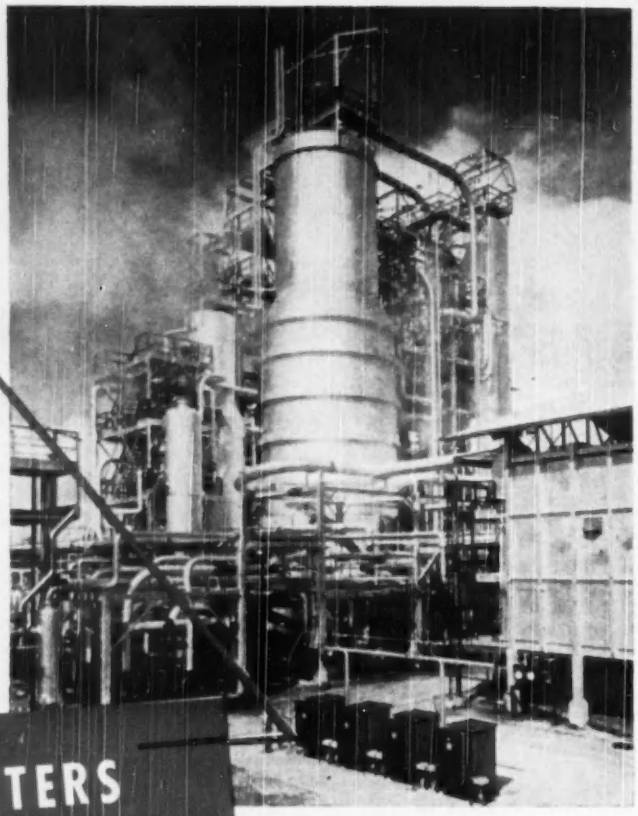
For clear and durable signs, dials, wiring diagrams, plotting boards and nameplates, look into the unusual advantages of LAMICOID, in Graphic, Translucent or Engraving grades. Ask our nearest sales office for complete information.

MICA *Insulator* COMPANY

Schenectady 1, New York

Offices in Principal Cities

EC&M Bulletin 1062 Type ZHS 2300 Volt Motor Starter in Type VIII enclosure for Class I, Group D hazardous atmospheric locations.



Photograph—Courtesy, Foster-Wheeler Corp., designers and constructors of this 48,000 barrels per day, 3-stage crude distillation unit.

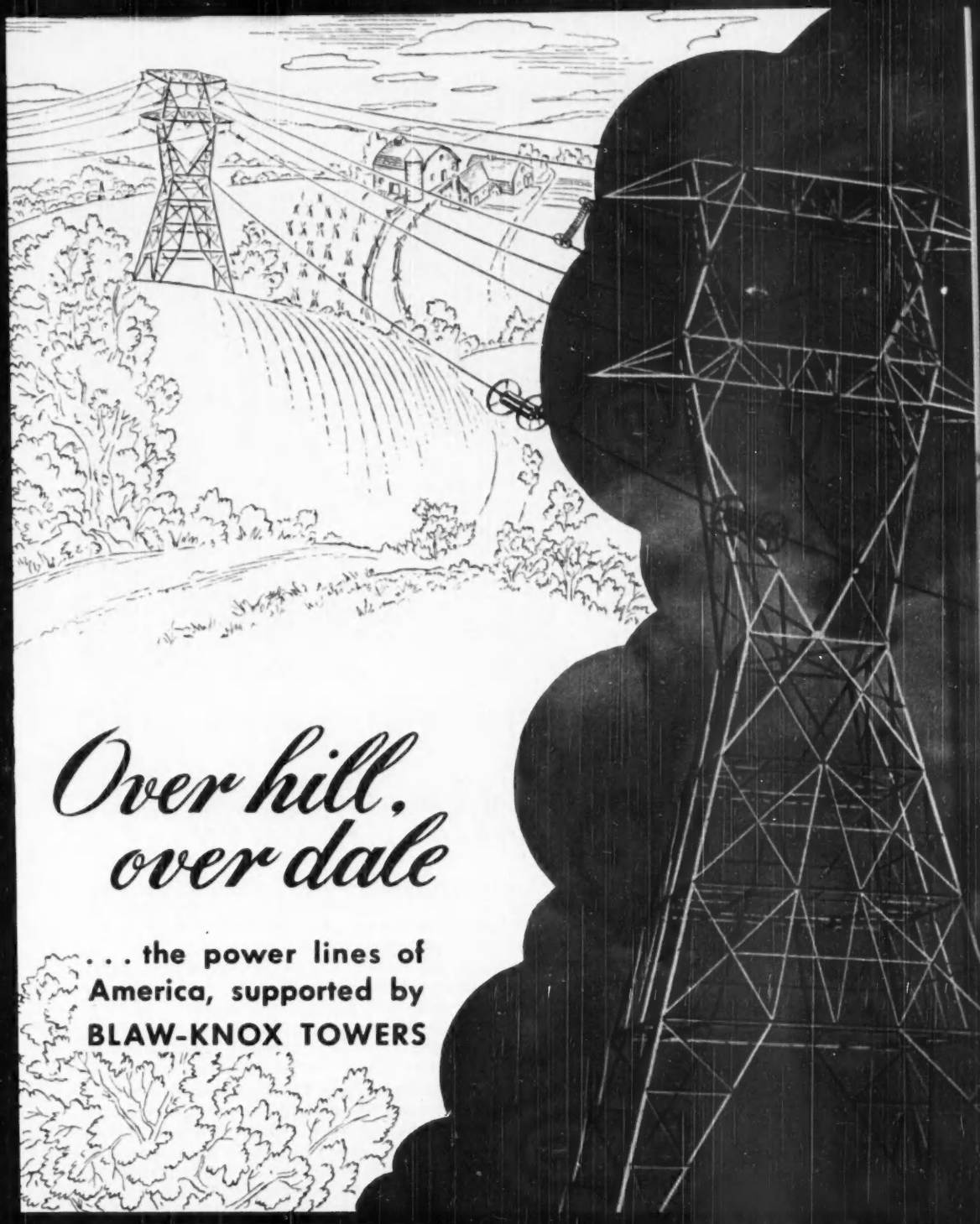
EC&M STARTERS
for 2300 Volt Motors
HELP BOOST PETROLEUM PRODUCTION

Oil immersion of the Type ZHS heavy-duty Magnetic Contactor in the rear tank of the starter permits making and breaking the main motor circuit under oil. The oil also keeps the mechanism well lubricated and corrosion protected—*eliminating the need for frequent inspection or maintenance.* The drain pipe with shut-off valve terminates at the front under the conduit connection box in which the overload relays are mounted.

EC&M Type ZHS Starters for *2300-4600 volt motors* are built in 50,000 KVA interrupting capacity and in the VALIMITOR (volt-ampere-limitor) style for use on power systems having up to infinite KVA.

***WRITE FOR* Bulletin 1062 and No. 23 *Accelerator* Bulletin describing EC&M 2300—4600 volt motor starters.**

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO



Over hill, over dale

. . . the power lines of America, supported by BLAW-KNOX TOWERS

BLAW-KNOX TRANSMISSION TOWERS

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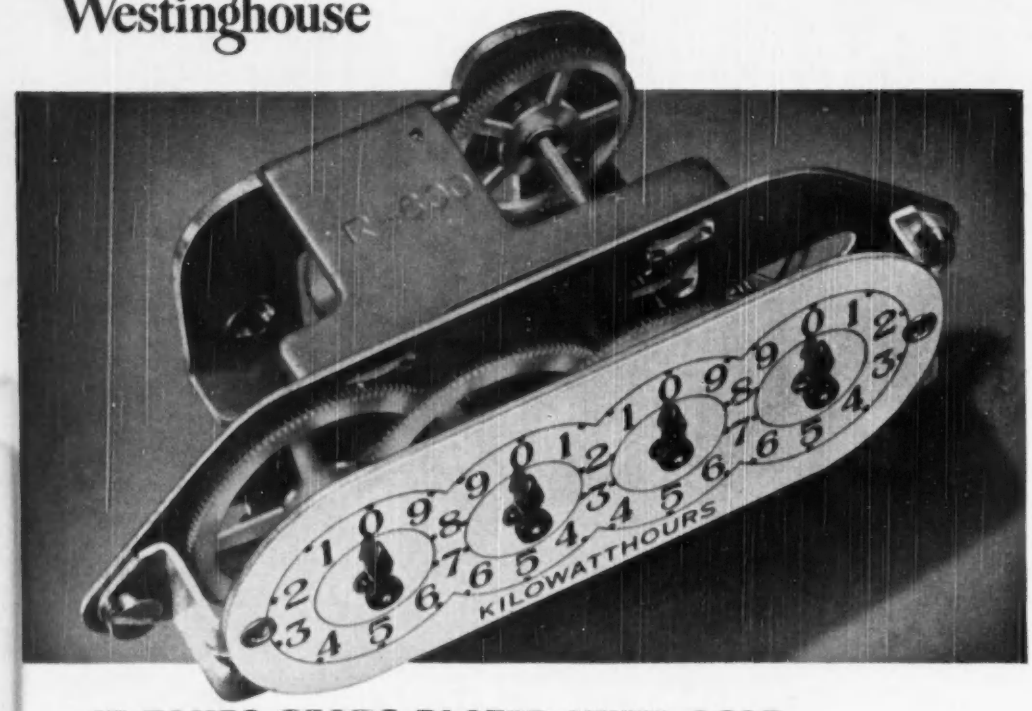
NEW YORK CHICAGO PHILADELPHIA BIRMINGHAM WASHINGTON

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



IT TAKES GEARS PLATED WITH GOLD

TO *Eliminate Corrosion* *

Gold is doubly valuable when it protects meter gears and shafts from corrosion under all atmospheric conditions. Friction is almost negligible for life. Only Westinghouse offers this protection.

And to make doubly sure of low friction . . . involute gear teeth are *milled*, not stamped. They *roll* smooth and free. The gold finish then preserves this fine freedom of motion under all operating conditions.

What's more . . . every precision register is *self-meshing* with the disk shaft, never too tight, never too loose.

Check your meter records. They'll prove that "extras", like gears plated with gold, actually give you the greatest return on your metering investment . . . over a *long period* of years.

Get detailed information . . . ask for the new booklet, "What It Takes for Long-time, Low-cost Metering", B-4665. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-40367

Westinghouse METERS

*A VITAL PART OF LONG-TIME, LOW-COST METERING

Now—Gulf Turbine Flushing Oil has been further fortified to provide an even more effective rust preventive film! Now you can be sure that all oil bathed surfaces in your new turbine lubricating system are completely protected!

Gulf Turbine Flushing Oil has highly preferential wetting characteristics — displaces water quickly on the internal surfaces of the lubricating system. It should be used as soon as practical after installation of the system.

Gulf Turbine Flushing Oil has excellent flushing action — cleans inaccessible parts of the system, readily picks up dirt particles and carries them to the filter.

An important advantage of Gulf Turbine Flushing Oil over other types (such as certain solvents) is that the undrained portion in the turbine system does not impair the lubricating value of the turbine oil. For Gulf Turbine Flushing Oil is itself a satisfactory lubricant.

Only one-third to one-half of a normal turbine oil fill is required for thorough flushing. Thus the expense of flushing your new turbine with low-cost Gulf Turbine Flushing Oil is nominal.

For complete information on this quality product and for recommended procedure for cleaning your turbine, call in a Gulf Lubrication Engineer. Write, wire, or phone today.

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I.D. FANS

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This municipal power plant, close to the business district of Lansing, Michigan, was architecturally designed to give the appearance of a commercial building. Elimination of unsightly chimneys, an earmark of power plants, was accomplished by the use of specially designed P-D Fan Stacks, recessed into the actual building structure.

P-D Venturi type Fan Stacks are normally short, but these stacks were made even shorter by increasing the angle of the stack wall and dividing the stack with a baffle.

P-D Fan Stacks are a complete draft producing unit consisting of fan, breaching and stack, integrated to produce the highest efficiency attainable. Thus, predetermined draft efficiency can be guaranteed since all components are designed, engineered and manufactured by one company . . . The Prat-Daniel Corporation.

For the answer to your draft problem consult our project engineers . . . for modern, high induced draft efficiency, install P-D Fan Stacks.

Project and Sales Engineers

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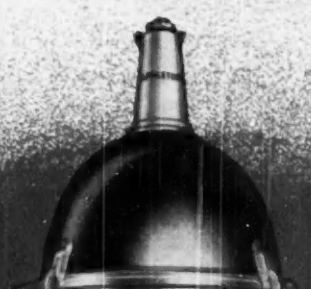
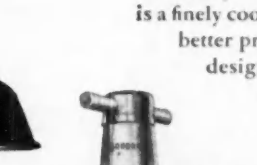


Industrialite High Mounting Fixture

GOOD LIGHT...

Industry's Most Essential Production Tool!

Standard Dome Reflector



The Stocklite for Stock Rooms

● When you plan industrial lighting with Appleton Equipment the result is a finely coordinated system that paves the way for top worker efficiency, better production. That's because Appleton fixtures are scientifically designed to provide the *right light*, without uncomfortable glare, troublesome contrast or shadow. Products of nearly half a century of experience, expert engineering and unequalled manufacturing facilities, Appleton Fixtures provide maximum illuminating efficiency at minimum installation, service and operating expense. Appleton Lighting Fixtures are available in the exact type and size for every industrial requirement—including hazardous locations—whether indoors or out. Appleton's skilled illuminating engineers are ready to help you solve your specific lighting problems. For the finest in lighting equipment, specify Appleton—Standard for Better Lighting.

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that you can use

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Durasheath® is the all-type cable for all-type use . . . in single or multi-conductors.

in ducts...

Tough Neoprene jacket eliminates rotted braids and jacket damage when pulling.

underground...

Ability of Neoprene jacket to resist oil, alkalies, acids, moisture, makes Durasheath the perfect cable for underground use.

in one continuous run!

DURASHEATH SOLVES DISTRIBUTION PROBLEMS . . . Underwriters' approved for all underground services . . . it's perfect for power and lighting circuits, industrial plants, mines, airports, farms, and housing developments.

DURASHEATH DOES THE TOUGHEST JOBS—THE BEST . . . *and at lower costs* . . . electrolysis, corrosion and extremes in temperature can't hurt it. It resists oil, flame, abrasion and cutting . . . as well as moisture, acids and alkalies in the soil. It's lightweight and flexible—reduces installation costs.

For more dependable power distribution systems, choose Durasheath. For more complete information contact your nearest Anaconda Sales Office or Distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

The right cable for the job ANACONDA®

WIRE AND CABLE

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Positive Action... Easy to Fuse

PE 33 years of "Know-how"

Southern States'
Porcelain-Enclosed
Dropout
Distribution
Cutout

- Designed for full dropout operation. Can be converted to 100 amp disconnecting switch by substitution of solid blade door assembly.
- The safest cutout made! Door completely dead when open. The PE-33 can be entirely hookstick operated and fused with SS bayonet-type hookstick or a clamp type stick. Door can be opened and closed by ANY hookstick, and removed and replaced by hand.
- High pressure contact maintained by phosphor bronze back-up springs on silvered contact surfaces.
- Mounting bracket meets NEMA and EEI standards for universal use with cutouts and lightning arresters.

Immediately available through your local jobber in the following ratings:
5 kv 50 amp
7.5 kv 50 amp

Southern States Equipment Corp.
HAMPTON GEORGIA

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Wagner Rural-Line Transformers . . .

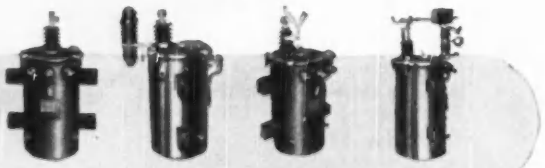
. . . Service Proved FOR MINIMUM MAINTENANCE!

Maintenance costs money—lots of money. Cost analyses show that continued operation is a major factor to consider when buying transformers. It *pays* to choose transformers that are service proved . . . for long life . . . for dependable performance . . . for minimum maintenance.

Service records from the field prove that Wagner Rural-Line Transformers require a minimum of attention and give unusually long, efficient service.

PERFORMANCE *Plus* PROTECTION

Wagner makes a complete line of rural transformers and offers a selection of types with protective features to meet your specific needs. Type HEF-7Z, illustrated at left, provides a wide margin of safety under all surge conditions with an expulsion-type lightning arrester (A) which is grounded through the transformer tank; and provides overload protection by a primary load limiter fuse (B) mounted on a spring arm assembly (C). Other protected types and a conventional type are shown below. Bulletin TU-1C gives complete details, write for your copy.



Wagner's nationwide organization provides fast, convenient service, with 29 branches ready to help you with your transformer problems.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation EST. 1891

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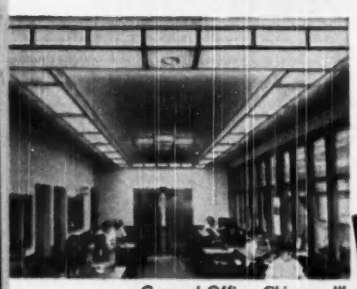
TM-1

YOU SELL MODULE INSTALLATIONS



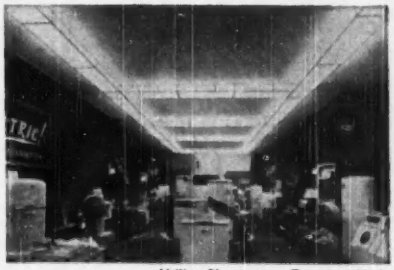
General Office. *Chicago, Ill.*

LIKE THESE

Bank. *Wheeling, W. Va.*

Automobile Showroom. *Ecorse, Mich.*

Display Room. *Dallas, Texas*



Utility Showroom. *Trenton, Mich.*

Appliance Store. *El Dorado, Ark.*

WHEN YOU TELL THIS SELLING STORY

module is custom-fitting

Here's the *new* lighting that *fits* any commercial interior to a "T". Four basic MODULE units are the "building blocks" or "dominoes" of light. They fit together easily, economically, to form over 50,000 different patterns. They custom-fit any room shape or size. They put the light *exactly* where it's needed. MODULE is the *only* lighting that *custom-fits* with standard low-cost units.

module delivers 20% MORE LIGHT

Proved in actual use—MODULE delivers 20% EXTRA light per unit! Yes—the MODULE translucent plastic molded louver passes 20% MORE LIGHT. This means more light per dollar—fewer fixtures required to meet footcandle specifications. This means *more* light, *better* light at no more than the cost of ordinary fixtures.

module installations are never obsolete

No MODULE lighting system is ever obsolete. Here's why: As lighting needs change, more units can be added at any time, at any point in the system—without installing a single new electric outlet box because MODULE units connect together electrically and mechanically. MODULE lighting is never "locked-in"—the "building blocks" of light simply slip into place easily and economically exactly as required.

module is newest, finest

And there's nothing in lighting that will *stay* newer and finer than MODULE. Yes—a MODULE installation remains modern for years, because: it custom-fits and "grows" with every lighting need; it delivers *more* light; its appearance has an undated "always contemporary" look. No ordinary fixtures can match these MODULE advantages.

TELL THIS STORY—IT SELLS

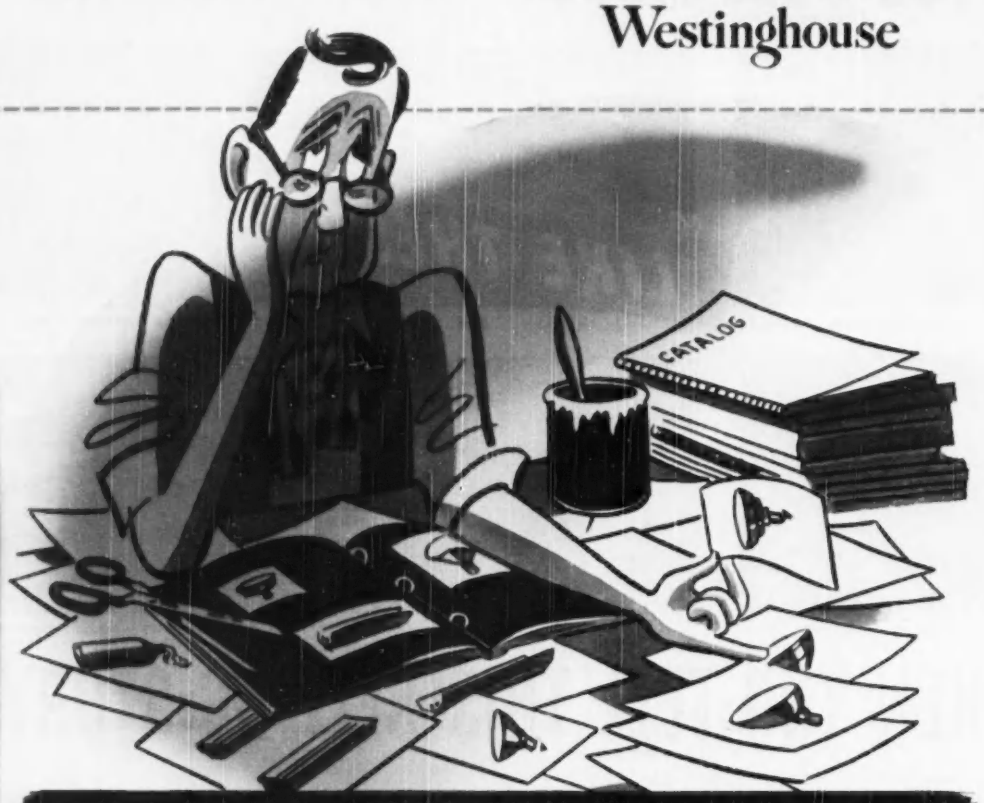
MITCHELL module

REG. U. S. PAT. OFFICE

IF YOU HAVEN'T ALL THE **module** FACTS, WRITE TODAY

MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Avenue • Chicago 14, Illinois

YOU CAN BE **SURE**.. IF IT'S
Westinghouse



Don't be a FIXTURE PICKER!

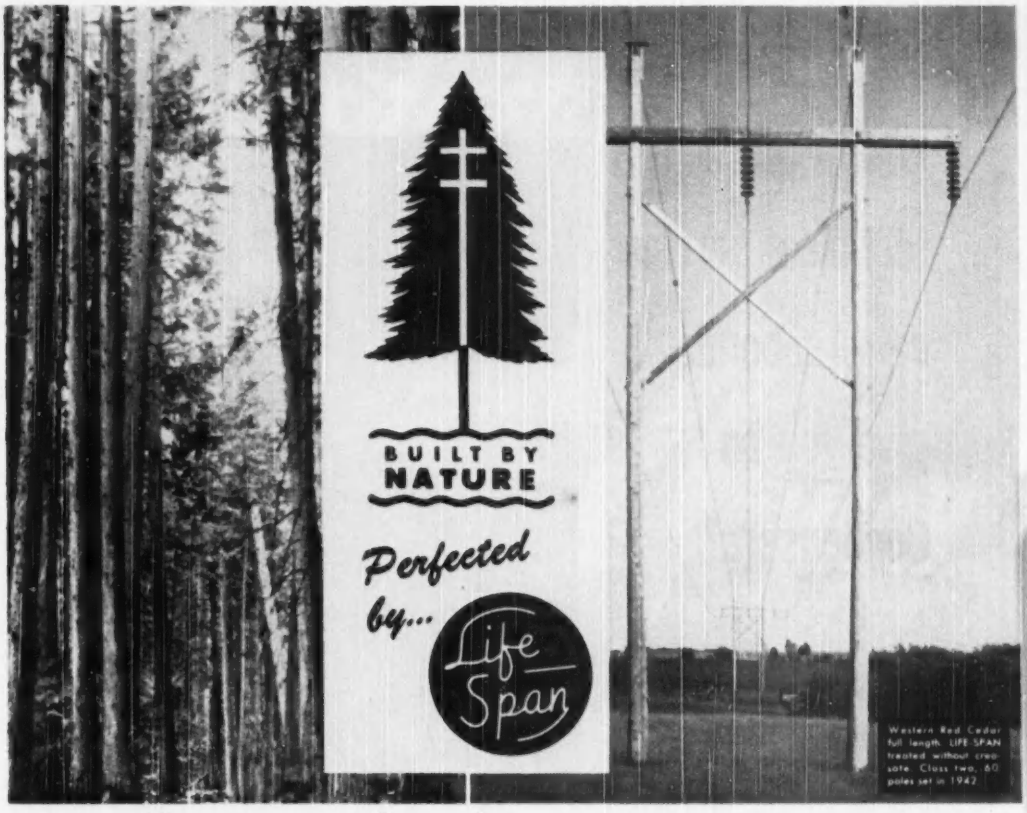
This "character" looks worried. He's picking lighting fixtures. But he won't find the answer in a magazine cutout.

What's more, there is no single "cure-all" lighting fixture. You know that, of course, but how many others do? Each luminaire has a different purpose—a different application—and a different economy depending on specific conditions.

Analyzing these conditions takes an expert. You need the services of a lighting engineer.

Whether you plan lighting, buy lighting, or install lighting, the services of a Westinghouse Lighting Engineer are available to you. J-04281

Westinghouse
PLANNED
LIGHTING
PAYS



The Perfect Combination . . .

WESTERN RED CEDAR POLES

LIFE-SPAN full length Immunization

Here truly is an unbeatable combination . . . Nature's most perfect poles treated the LIFE-SPAN way. Every Western Red Cedar Pole receives complete end-to-end treatment, first in a hot solution to drive out the air and prepare the wood cells for preservative absorption; next a sudden submersion under a cold pentachlorophenol solution which contracts the expanded air in the cells. This creates a vacuum sufficient to pull the solution deep into the sapwood. Pole protection is sealed for life, insuring dependable service up to pole line obsolescence.

Linemen like LIFE-SPAN poles because they are clean, easy to handle, and safe to work on. Utility companies like them because they offer dependable service and they build good public relations for the companies using them.

To be sure, to be doubly safe . . . specify LIFE-SPAN Western Red Cedar Poles. .

The same LIFE-SPAN treatment is also available for Fir, Western Larch and Lodgepole Pine.

CONSOLIDATED TREATING CO.
MINNEAPOLIS, MINNESOTA

For further information write any of the following:

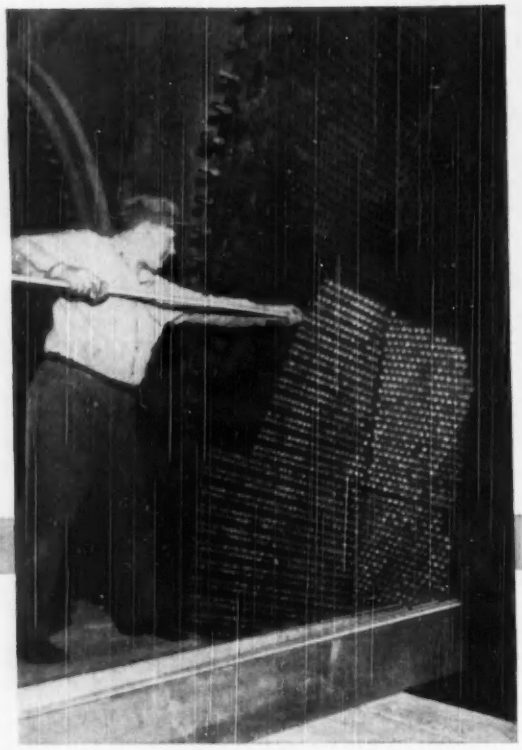
SCHAEFER-HITCHCOCK CO.
Sandpoint, Idaho
Suppliers for Joslyn Mfg. & Supply Co.

NAUGLE POLE & TIE CORP.
Chicago, Illinois

PAGE & HILL, INC.
Minneapolis, Minnesota
50 Church Street, New York, N. Y.

B. J. CARNEY & CO.
Spokane - Minneapolis

What technical service can Anaconda give you on Condensers?



AMBRALOY 927 GOING IN AT SEWAREN. *These tubes are being installed in part of Foster Wheeler Cross Flow 60,000 sq. ft. condenser – one of three at the new Sewaren, N. J. plant of Public Service Electric and Gas Company. Salt cooling water is pumped from the Arthur Kill between Raritan and Newark Bays.*

Every large user and manufacturer of condensers builds up wide experience with tube and tube sheet materials. The American Brass Company serves many such users and manufacturers, shares with each his toughest problems, makes this wider experience available to all.

We maintain special laboratory facilities for this work – keep detailed records of problems, conditions, findings – use these data plus the results of continuous laboratory and field tests to solve new problems.

These facilities can help produce the answers to your questions – suggest materials that will give your condensers more dependability, longer life, more value under specific conditions.

We hope you will work with us and let us work with you. Write for Publication B-2, *Anaconda Tubes and Plates for Condensers and Heat Exchangers*. Please address The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

50-11A

For efficient heat transfer ANACONDA®

CONDENSER TUBES

Another *first* for P-L

P-L 4-Way Anchors incorporate all the features of the famous P-L 2-Way Anchors . . . features proven by use in the past few years. There are no levers, hinges or multiple pieces to bind or get out of order.

P-L 4-Way Anchors are easy to install . . . tamping force is exerted directly onto sharp-edged blades. P-L 4-Way Anchors are made in 6,000, 8,000, and 10,000 pound sizes.

Compare the ease and simplicity of installation, and greater holding power of P-L 4-Way Anchors, with other more costly and complicated 4-way anchors. Write today or contact your preferred distributor for information and literature. PL50-1

PIEPER-LILLARD, INCORPORATED

ST. LOUIS 22, MISSOURI

MAKERS OF P-L 2-WAY ANCHORS—SPREADING TOOLS—WIRE STRINGING PULLEYS—LAY-UP GINS—CHAIN BINDERS

SIDETRACKED *from the road to success –by a rivet*

Joe was on his way to setting a new sales record. Then came that wire from the home office . . .

Corrosion had caused a rivet to fail on a vital piece of processing equipment; other fastening failures were anticipated; production had to be stopped temporarily.

This is not an exceptional case. It's happened many times. It could happen to you *any time*. And the only way to protect yourself against such a loss is to standardize on non-ferrous or stainless steel bolts, nuts, screws and accessories.

Harper makes these Everlasting Fastenings in over 7000 different sizes, types, alloys—Brass, Bronzes, Copper, Monel and Stainless Steels. In addition to resisting corrosion, they are non-magnetic, long-lasting, reusable—most economical in the long run.

Large stocks ready for delivery from distributors and warehouses in principal cities. Write for catalog, current stock list: The H. M. Harper Company, 8205 Lehigh Ave., Morton Grove, Ill.

HARPER

EVERLASTING FASTENINGS

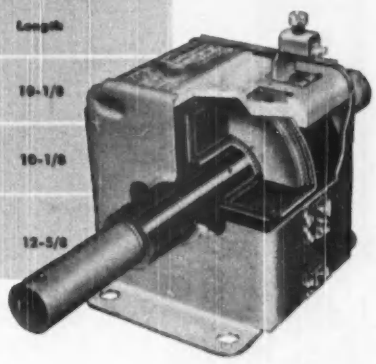
AMERICA'S LEADING SPECIALISTS

New York Office and Warehouse: 200 Hudson St.
Los Angeles Office and Warehouse: 835 E. 31st St.
Branch Offices: Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Milwaukee, Oakland, Philadelphia, Pittsburgh, St. Louis, Seattle, Toronto (Canada)

IN NON-FERROUS AND STAINLESS STEEL FASTENINGS

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

Lighter...		Smaller...			
Primary Amperes	Secondary Amperes	Weight Pounds	Sizes in Inches Height	Width	Length
200	5	6	4	3-9/16	10-1/8
400	5	7	4	3-9/16	10-1/8
200-200 3-wire	5	7	4	3-9/16	12-5/8



NEW
"MR" CURRENT TRANSFORMER

It's smaller... fits smaller meter boxes—mounted separately it requires minimum space. Simplifies switchboard and panelboard installations, too.

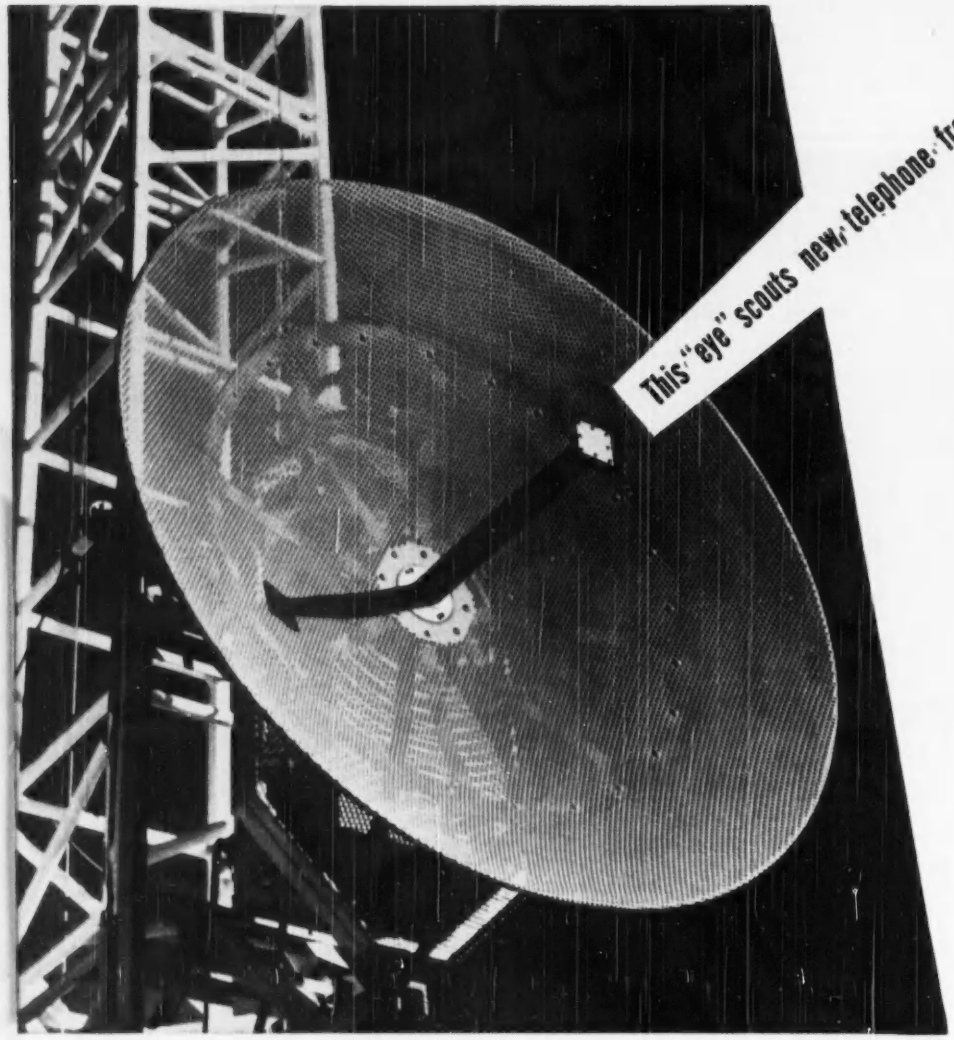
It's lighter... easier to handle and install.

It costs less... save up to ⅓ on initial cost alone.

Here's why... a new Hipersil® oriented core steel, and small through-type primary conductors make construction small, light and economical. Ask your Westinghouse representative for complete information, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70554

Westinghouse
CURRENT TRANSFORMERS



Throughout history, scouting parties have gone out ahead of man, ahead of settlements, ahead of civilization itself. Today, Bell System scouts are engaged in a new kind of exploration — charting a path for microwaves — using equipment specially designed by Bell Telephone Laboratories.

The portable tower shown is constructed of light sections of aluminum and in a few hours may be built up to 200 feet. Gliding on rollers, the "dish," with its microwave transmitter or receiver, is quickly positioned for line-of-sight transmission, then oriented through electric motors controlled from the ground.

Test signals show how terrain and local climate can interfere with microwave transmission. Step by step, Bell's explorers avoid the obstacles and find the best course for radio relay systems which will carry television pictures or hundreds of simultaneous telephone conversations.

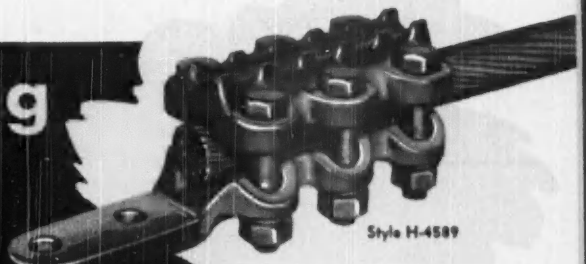
A radio relay link similar to the one between New York and Boston will be opened this year between New York and Chicago. Later it will be extended, perhaps into a nation-wide network — another example of the way Bell Telephone Laboratories scientists help make the world's best telephone system still better each year, and at lowest cost.

BELL TELEPHONE LABORATORIES

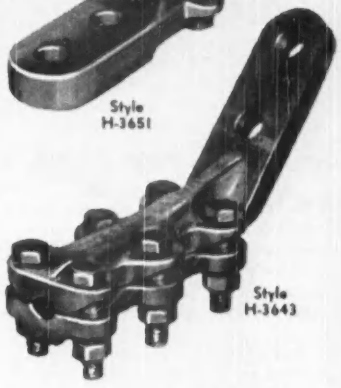
EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

RECOMMENDED!

for Connecting Aluminum Cable or Tube to Copper Terminal Pad


Style H-4589

Style H-3651


Style H-3643

Pacific Electric
Type ALT Terminals

- **Aluminum Body is Cast and Heat-Treated for High Strength**

  No electrolytic action or differential expansion between aluminum conductor and terminal body. Heat treating distributes alloys uniformly, improves tensile and yield strengths and hardness.

- **Large-Area-Clamping of Aluminum Conductor**

  No cold flowing of conductor.

- **Heavy Aluminum-Copper Bi-Metal**

  No electrolytic action
  No de-zincification
  No solder-joint failures
  No plating, galvanizing or tinning failures.

- **Reversible Clamp Cap**

  One side grooved for small cables, and the other, for large.

BI-METAL PLATE
for non-corrosive contact, furnished with each terminal

Get All Facts . . .

Call PACIFIC ELECTRIC MFG. CORPORATION

[illegible] THIRD STREET SAN FRANCISCO 24 CALIFORNIA [illegible] GARY INDIANA

Other Representatives in Principal Cities

There is NO SUCH THING as an "RLM TYPE" Lighting Unit!

Either it is RLM CERTIFIED or it is NOT.
The Only Way To Be Sure Is To

SEE the RLM LABEL!

Looks can be deceiving in lighting units, too! A lighting unit may LOOK like an RLM Unit, it may have a similar outward appearance, contour, shielding angle, etc.—but unless it is made in accordance with RLM Standard Specifications and carries the RLM Label, it is *not* an RLM Lighting Unit. There is no such thing as an "RLM Type" that does not have the label.

Why No "RLM TYPE"? The RLM Label on fluorescent and incandescent lighting units, not only assures the buyer of design and construction that meets certain minimum standards*, but also provides him with a WARRANTY of UNIFORM QUALITY.

Only those products of lighting manufacturers which are *consistently proved* to be of *uniform quality* and meet the published specifications of the Institute are permitted to bear the RLM Label. This uniformity of quality is of exceptional importance to all those who buy, use, specify, recommend or sell lighting equipment. It is essential to uniformly satisfactory lighting equipment performance, that each unit in the system perform with equal efficiency to the other . . . that ballasts function with uniform efficiency . . . that the reflection factor be uniform from unit to unit . . . that the units be of uniformly durable construction with the identical-gauge steel and the same thickness Porcelain Enamel. Such uniformity reduces to a minimum the plague of spotty performance by individual units in a lighting system.

How RLM Checks Uniformity of Quality

According to the RLM testing and inspection procedures, representatives of the Electrical Testing Laboratories periodically visit plants of all RLM member-manufacturers. They take lighting units right off the assembly lines and out of stock for testing and inspection at their laboratories. They may also obtain test samples directly from the distributors' shelves or out of contractors' stocks in order to check Uniform Quality at every level of distribution.

This activity of the RLM Standards Institute, which makes possible the Warranty of Uniform Quality, is not duplicated by any other agency in the lighting industry. That is why there is no such thing as an "RLM Type" Lighting Unit.

FREE SPECIFICATIONS BOOKLET! This

up-to-date 56-page booklet tells why it is important to SEE THE RLM LABEL before buying or specifying lighting units. It contains all RLM Specifications, covering vital construction and performance factors that should have major consideration by the buyers and specifiers. It is an indispensable help in the sale of industrial lighting units. For your complimentary copy (or copies), sent without obligation, write:

RLM Standards Institute,
Suite 823, 326 West Madison St.,
Chicago 6, Illinois.

This Advertisement is published in the Interest of the Entire Lighting Industry by

RLM STANDARDS INSTITUTE
INCORPORATED

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

*Every RLM Unit Must Conform with Certain Minimum Standards such as these:

Porcelain Enamel Reflectors – all RLM Units must have a specified thickness of Genuine Porcelain Enamel fused to steel. This unsurpassed high-reflection, high-diffusion reflecting surface is the only commercially available finish that cannot deteriorate or corrode. Simple soap-and-water cleaning quickly restores it to original efficiency.

High-Quality Ballasts – RLM Fluorescent Units must be equipped with Certified Ballasts which prevent high temperature ballast operations, supply proper starting current and maintain proper operating watts to the lamp. Because of their high power factor, present wiring capacity can be utilized most efficiently.

Reflector Design – every RLM Unit must conform with the most accepted principles of Illuminating Engineering. Such design protects the workers' eyes while delivering, not only the most light per dollar, but also the required quality of light for the individual seeing task.

Sound Construction – RLM Units must comply with high fabrication and materials to insure standards of maximum resistance to sag, distortion and breakage.

R-607

They did it BETTER with ISOLATORS

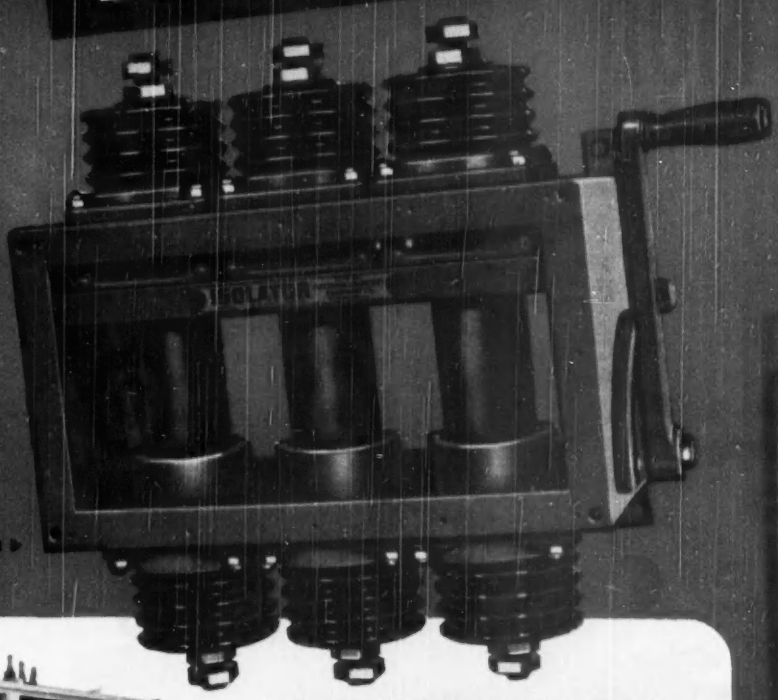
The telescoping action of the Three E ISOLATOR when operating gives it certain definite advantages over conventional types of high voltage disconnecting devices.

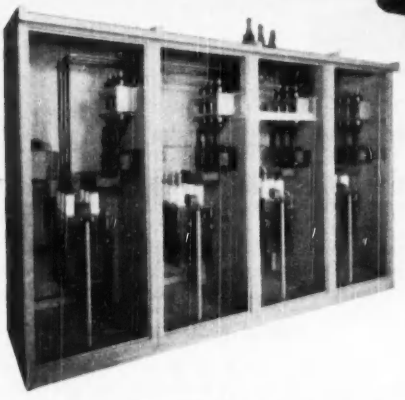
The installations pictured herewith show two of many installations made throughout the country wherein ISOLATORS helped solve high voltage switching problems.

Upon investigation you, too, will find that YOU CAN DO IT BETTER WITH AN ISOLATOR.

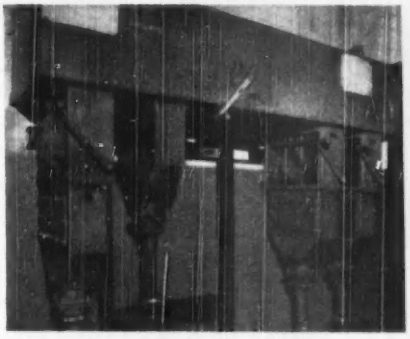
The next time you have a switching center, cubicle or vault to layout, put your problem up to us. We can almost invariably show you how to improve it by using ISOLATORS.

3 P.S.T., 600 ampere, 7500 volt ISOLATOR ▶





In this outdoor cubicle a switchboard manufacturer using ISOLATORS was able to save space, for equipment not yet installed, for its ultimate user, a large oil company.



A large automobile manufacturing company by using Cable ISOLATORS was able to not only save space but provide safety first features in one of their important switching centers.

Send for Bulletin 140. It tells the whole story

THREE E — ELECTRICAL ENGINEERS EQUIPMENT CO. — MELROSE PARK, ILL. U.S.A. — THE MARK OF QUALITY

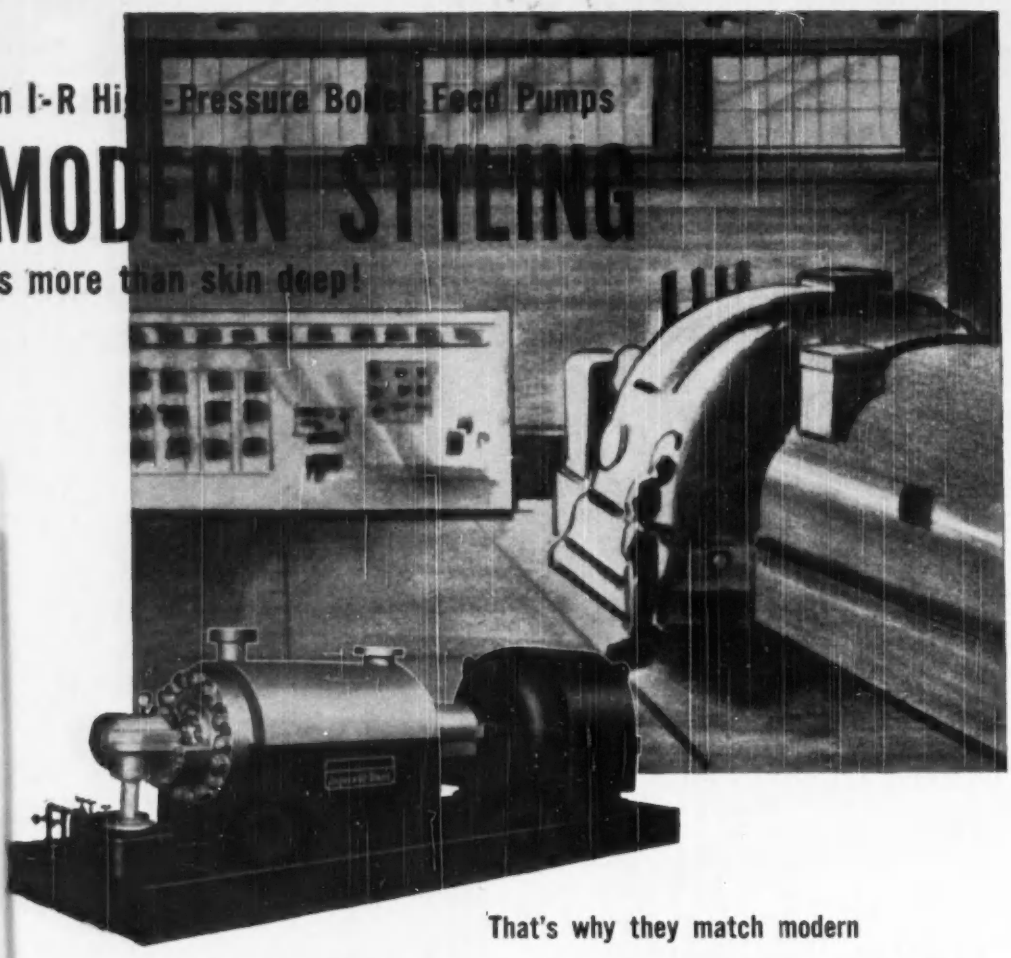
ELECTRICAL ENGINEERS EQUIPMENT CO.

MELROSE PARK, ILLINOIS

In I-R High-Pressure Boiler-Feed Pumps

MODERN STYLING

is more than skin deep!



That's why they match modern central station equipment in performance as well as appearance

The distinctive, neat appearance of I-R double-case pumps is evident from the illustration above. A minimum of external piping, compact lubrication assembly, sheet metal lagging that blends in with the main pump support, and many other new design features—all contribute to their modern styling. However...

THERE'S MORE THAN MEETS THE EYE

I-R double-case pumps have kept pace with today's improved central station equipment in performance, too. And that's why so many of America's power producers have specified I-R boiler-feed pumps...to modernize and increase the output of their present facilities or as a part of a completely new station.

HERE'S A SUGGESTION!

If you're thinking of a new high-pressure feed pump, call your nearest I-R branch office. An engineer will be glad to tell you all about today's most modern, dependable boiler-feed pumps: Ingersoll-Rand's Class CHTA and CHTB double-case pumps—*the power industries' first choice for really high pressure service.*

Ingersoll-Rand

CAMERON PUMP DIVISION 471-10

11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL AND GAS ENGINES

2-WAY PROTECTION WITH SQUARE D CIRCUIT BREAKERS

RESIDENTIAL and INDUSTRIAL

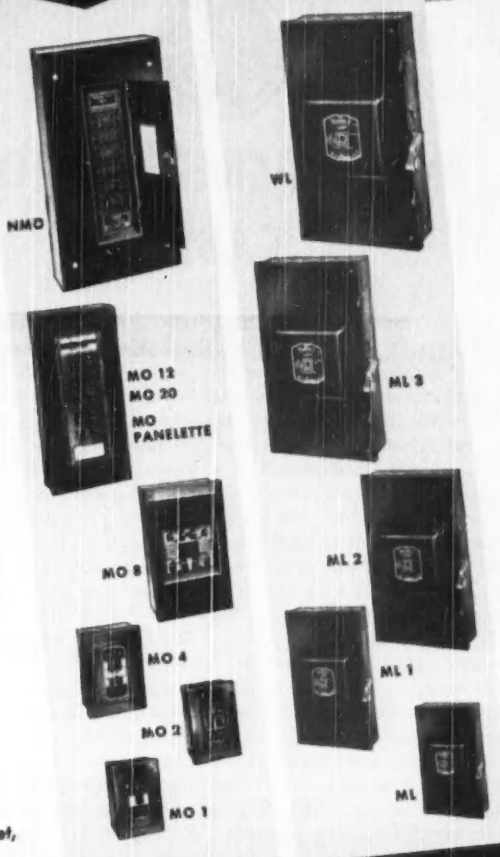
THERMAL-(Coilless)-MAGNETIC

—combining the proven advantages of both Thermal and Magnetic tripping elements. They give positive protection against dangerous overloads and act instantaneously on "shorts." Useless tripping on harmless momentary overloads is eliminated.

1. **THERMAL** element is a bi-metal providing positive and timed response to heating effects of both load current and surrounding atmosphere. The life of wire insulation is prolonged by limiting total temperature to a safe value.

2. **MAGNETIC** element responds instantaneously to the higher values of current characteristic of dangerous overloads and "shorts." Damage is minimized.

Both **ELEMENTS ARE NEEDED FOR** *Complete* **PROTECTION!**



Write for Bulletin SA 590
Square D Company, 6060 Rivard Street,
Detroit 11, Michigan

SQUARE D COMPANY

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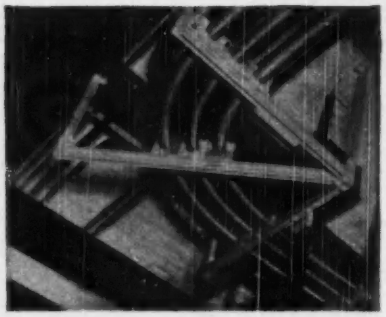
SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

Give installation problems...



How one manufacturer solved a difficult installation problem through the use of flexible interlocked-armor cable.

THE RUN-AROUND

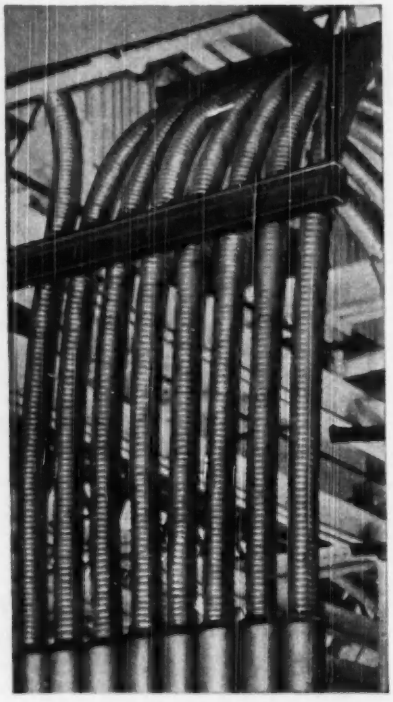
with INTERLOCKED-ARMOR CABLE

Pillars, I-beams, piers, partitions, and other obstacles often interfere with the installation of new plant power circuits. Result? Expensive drilling, channeling and tricky layouts . . . extra plant downtime . . . increased over-all installation costs.

However, there *is* a simple low-cost solution—time-saving General Electric *interlocked-armor cable with the famous No. 1799 varnished-cambric insulation.* This self-protecting cable was specifically designed to facilitate installation of plant power circuits in difficult locations. A ready-to-install cable assembly, G-E interlocked-armor cable may be readily bent around obstructions. It can be strung over long runs without pull boxes. It need merely be laid up on existing beams or hung with wire brackets.

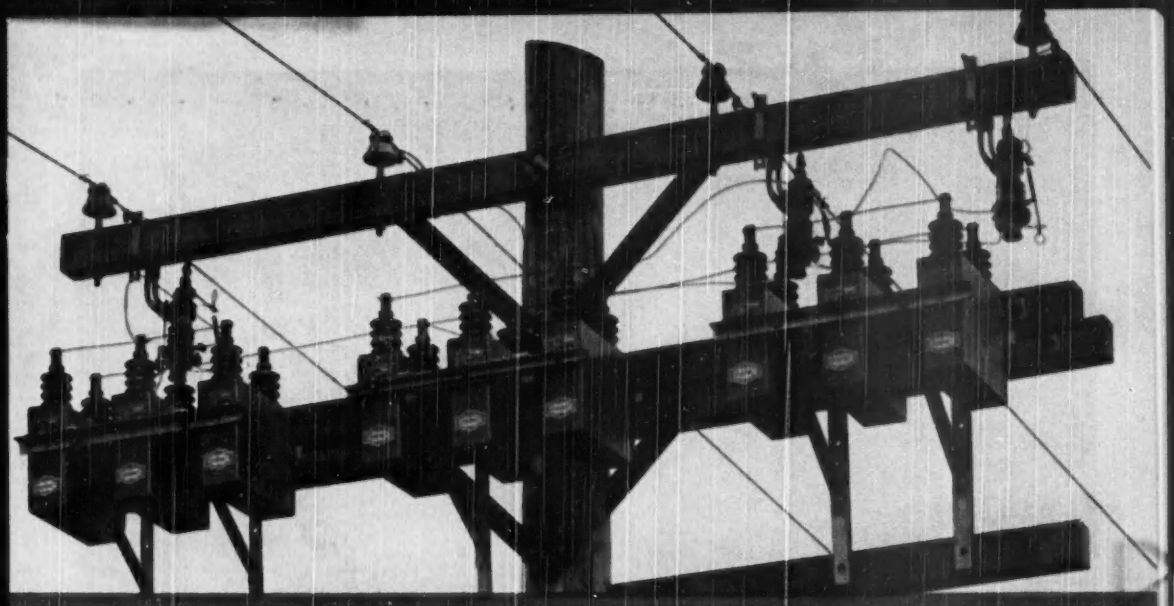
There's no further protection to fuss with. No complicated layouts to plan. No wire pulling. In some cases, you can actually save up to 50% on time, 70% on weight, and—at the same time—get improved circuit voltage regulation, through closer spacing of conductors. Investigate G-E interlocked-armor cable on your next power installation—it may pay you big dividends.

For complete data on General Electric interlocked-armor cable, write to Section **W3-427,** Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.



General Electric interlocked-armor cable runs around obstacles — needs no special installation techniques!

GENERAL ELECTRIC



KEARNEY

Gives You Extra Advantages in SHUNT CAPACITORS for Power Factor Correction

After several years of intensive study, Kearney research engineers have designed a capacitor that eliminates the known faults of existing capacitors. 15 years of capacitor building experience under the supervision of specialists who insist on standard high quality production go into the manufacture of Kearney Capacitors. All of which is your assurance of getting a product designed and manufactured to do the job better.

JAMES R. KEARNEY CORPORATION, 4224-42 Clayton Ave., St. Louis 10, Missouri
Canadian Plant, Guelph, Ontario

IMPORTANT ADVANTAGES...

1. Designed to fit all standard mounting racks. Permits replacement and interchangeability.
2. Extra heavy wet process porcelain bushings (sealed in thermosetting compound) securely anchored to the case with silicone gaskets.
3. Welded sheet steel case with hot zinc spray and enamel coating provides double protection and greatly reduces maintenance cost.
4. Kearney capacitors are built to NEMA specifications and are guaranteed for one year against defective material and workmanship

AND

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

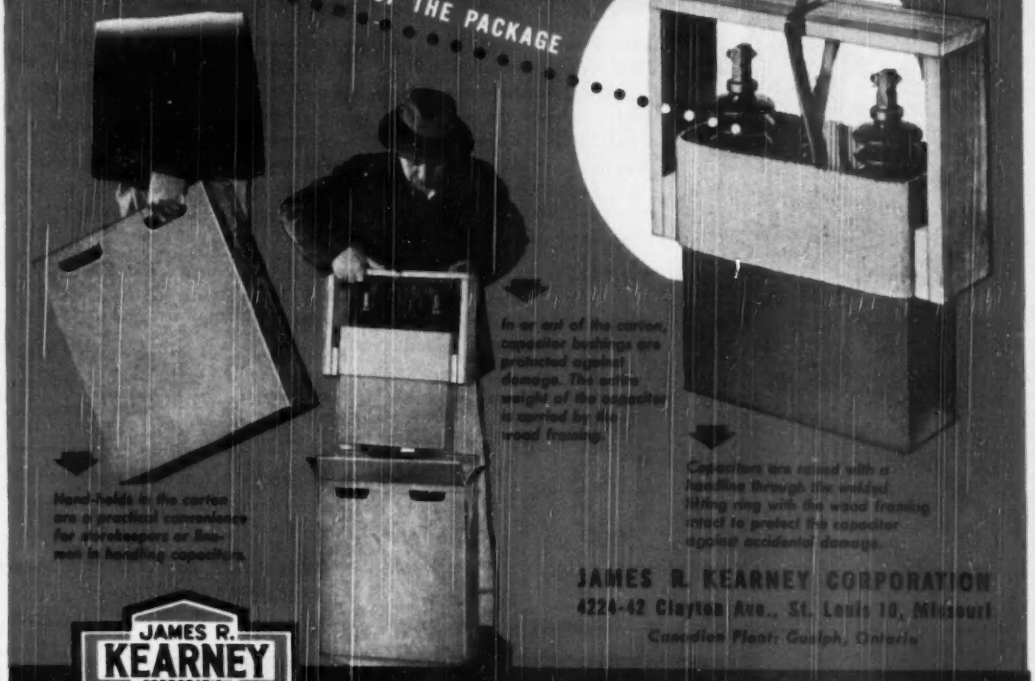
Better Construction – *SAFER* Maintenance

Install KEARNEY
SHUNT CAPACITORS

5 THE EXCLUSIVE KEARNEY PROTECTIVE PACKAGING FEATURE

The loss of vacuum, because of damage to the bushing through careless handling, is the greatest single factor that causes faulty operation of a capacitor. Kearney's protective packaging eliminates this possibility. The wooden frame and corrugated box protects the capacitor from the moment it leaves the production line at the factory until it is safely installed on its rack at the substation.

SAFETY ASSURED IN OR OUT OF THE PACKAGE



Hand-holds in the carton are a practical convenience for storekeepers or linemen in handling capacitors.

In or out of the carton, capacitor bushings are protected against damage. The entire weight of the capacitor is carried by the wood framing.

Capacitors are raised with a hoisting through the molded lifting ring with the wood framing intact to protect the capacitor against accidental damage.

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Many people think that Lapp makes a fine grade of electrical porcelain.

Lapp cherishes this reputation, and we go on making good porcelain, to merit this confidence.

Among other things, Lapp believes that good quality is important in distribution insulators—that the dependable performance of distribution lines depends on dependable electrical and mechanical performance of the insulators. Lapp believes that distribution insulators made of sound porcelain, with rounded, smooth, non-abrading contours, will improve the dependability of your distribution lines. Lapp believes that the security of distribution lines is important enough to justify the complete electrical testing of every distribution insulator before it is shipped.

Lapp builds the kind of distribution insulators it believes in. There's a Lapp representative in your area who'd like to discuss with you the possibility of supplying Lapp Insulators for your distribution insulator requirements.

Description and specifications of Lapp distribution material appear on page 13-18 of Lapp Catalog No. Seven (green cover). If you do not have a copy of this catalog, we'll send one on request.

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LAPP INSULATOR COMPANY INC., LEROY, NEW YORK

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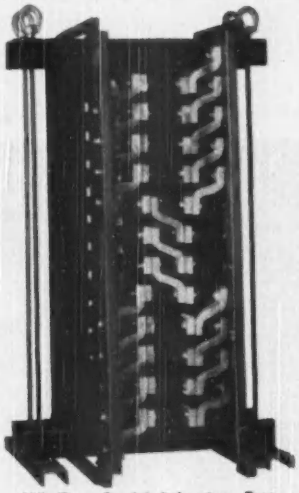
to meet

Your Exact Requirements

Special, Custom Built

for a variety of applications



115 Kv.a. Special Laboratory Transformer, with Twelve 6-Volt Secondaries of 1600 amperes each, arranged for series or parallel connection.

The designs and parts of SORGEL standard transformers are readily adaptable to a large variety of special transformers, enabling us to furnish quickly and economically *Air-Cooled* Transformers of most any specifications within our standard size range of ¼ to 2000 Kv-a.

Special *Air-Cooled* Transformers can be furnished enclosed in steel cases like our standard types, or without enclosures for panel mounting, or for installation with other equipment. They can also be made portable by being equipped with wheels, or casters, or handles.

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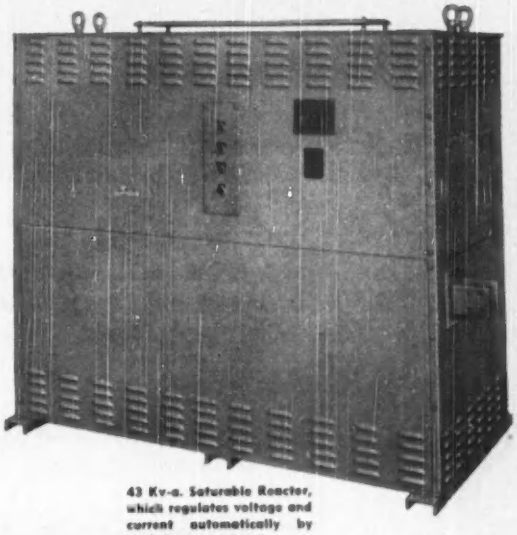
Tap changing. **Current regulating.**
Voltage boosters. **Saturable Reactors.**

For years we have been designing and building transformers for a variety of uses. Many have been specially built to meet special requirements.

You have here, at your service, an organization of specialists, both engineers and shopmen, to design and build the special transformers you need.

Your inquiries for special *Air-Cooled* transformers are welcomed, and will be given our careful and prompt attention.



43 Kv-a. Saturable Reactor, which regulates voltage and current automatically by push button control.

We also manufacture a standard line of *Air-Cooled*, dry-type general purpose transformers and unit substations.

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★ **Convenient pocket-size...**

small and compact—without sacrifice of performance—completely insulated for safe use.

★ **Complete variety of ratings...**

in a-c, d-c and rectifier types for the full range of current and voltage measurements.

Westinghouse has this great, new, portable instrument line ready for you now . . . the first instruments in the low-priced field that are specifically designed and manufactured to provide *all* of these features. Phone, write or wire your nearest Westinghouse representative. He will have an experienced instrument specialist help you plan your needs, whether they be portable, panel or switchboard instruments. Write for C.S. 43-100. Westinghouse Electric Corporation, 95 Orange Street, Newark, New Jersey.

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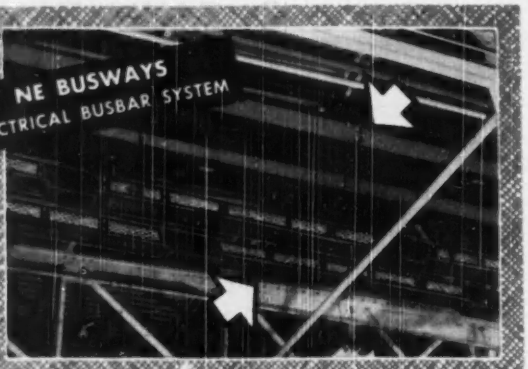

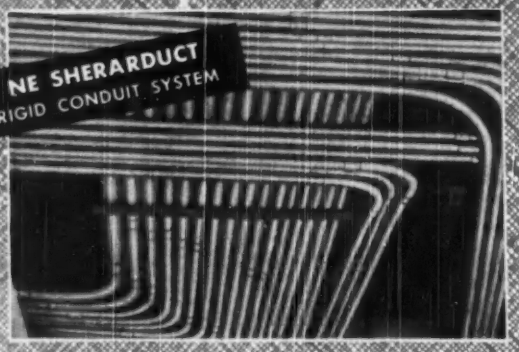

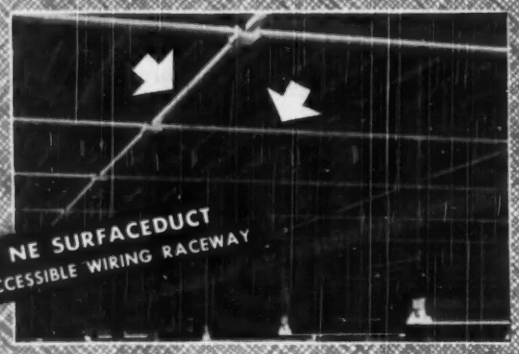

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1950 Looks Good

In AUGUST 1949 who would have believed that electric power output would be running 10% over the previous year by April 1950? And now that the industry has reached this satisfactory level of growth, almost two years in one, who can predict that it will continue for more than a few months?

Looking back to the August 27, 1949 issue of ELECTRICAL WORLD when the growth curve was scraping bottom and business was just beginning to see the spark of renewed activity, we made a prediction. We estimated an increase in power output in 1950 of from 10% to 12% over 1949. Such an optimistic forecast was based upon a fairly high rate of industrial and building activity.

Now that business has recovered and the growth curve has regained its normal virility, will confidence in the future receive a new impetus and will plans for new projects be removed from the shelf? Certainly no one should become over-confident when business again begins to look good. The shrewd executive will look twice before he revises his plans for the next two years. But as is the nature of the electrical industry, plans must go forward now for power capacity in 1951 and 1952. An extra 2 or 3% in load growth will bring a generating unit back a year in terms of required completion date. And in terms of the immediate future, distribution system construction must go forward immediately if unexpected growth is to be expected in 1950.

Let us look at the current record of activity creating good business and the increase in power consumption. The *Business Week* index of industrial activity has reached a new post war high of over 200. Cost of living was down to a rate of 166.5 in February compared with 169 a year ago. Unemployment is above 4 million but is not expected to rise materially. Demand for industrial products is high.

Although industrial construction is down some 10% from 1949, home construction is tending to go above last year. S. Morris Livingston, writing in the *Survey of Current Business*, figures it this way. Construction of dwelling units during the past three years has been two or three times that necessary to take care of the normal increase in households. About two-thirds of the backlog of demand that existed at the end of the war has been wiped out; one third remains. Add that to the normal rate of home-building, and the figures point straight to the conclusion that the housing boom will keep on at least through 1952.

Consumer buying power is also holding up because wages increased faster than the cost of living. The prewar level of individual debt ran around $20 billion. Repayments and interest charges took about 12% to 13% of disposable income. Now individual debt has reached $50 billion and is still climbing. But repayments and interest take less than 12% of today's total disposable income. A. C. Farmer of Westinghouse points to another favorable factor indicating stability in business. He feels that the ratio of bank deposits to bank loans of almost two to one assures an adequate supply of credit for the near term.

These economic factors measuring today's business conditions give us confidence in the soundness of the present trend in electric power consumption. It behooves those responsible for future adequacy of electrical facilities to evaluate this situation with considerable accuracy and foresight.

Shortage of Engineers Impends

IN 1946, '47 and '48 and in the war years preceding, the national economy had places for more engineering graduates than were available. In 1949 there were more graduates than places for them. In 1950—well, no one knows. All depends on the state of the economy in June, but probably there will not be too many graduates for the economy to absorb.

What about the years following? According to the American Society for Engineering Education, reporting a study of secondary school and engineering college enrollments, a shortage of engineering graduates is likely to develop after 1952. Freshmen in engineering colleges numbered about 93,000 in the fall of 1946, about 8.6% of high school graduates of the preceding June. The pre-war average of this ratio was about 3.2%. Enrollments have declined steadily since 1946, were down to 3% of high school graduates in 1949.

From the 93,000 freshmen of 1946, about 55,000 have survived to be seniors now, and of these some 51,000 will become graduate engineers this year. Assuming, as appears to be the prospect, a gradual return to pre-war ratios of enrollments of freshmen and of their survival to graduation, there is indicated a steady decline in numbers of graduates from about 35,000 in 1951 to a low of 15,000 in 1957 and then a slow rise to about 21,000 in 1965.

Jobs for graduates in actual engineering work are estimated by the Bureau of Labor Statistics to average between 17,000 and 18,000 per year in the present decade. Additional jobs in which engineering training is utilized will offer opportunities to many more thousands of graduates. From these data it appears that there will be a serious shortage of engineers from 1954 to 1965 or later unless freshman enrollments pick up considerably. It seems incumbent on industry and government to see that they do.

TVA Distributor Decries House Heating

"UNLESS ADEQUATE rates to compensate for the terrific winter peaks are established, electric house heating will ruin the electrical business."

These words were not spoken by a representative of the investor-owned electric utilities. They come from down TVA way. They are quoted from the March 16, 1950, *Press-Scimitar* of Memphis, Tennessee. Thomas H. Allen, head of the municipal gas and electric system of that city (a distributor of TVA power), uttered them, according to the news story, at a meeting of the Tennessee Valley Public Power Association.

There have been previous expressions by other distributors of TVA power indicating a certain peevishness in regard to house heating on TVA rates. But this, we think, is the first to appear in the public prints; anyway it is a striking quotable one.

"You can afford to sell anything for a price", continued Allen, "but at the proper price nobody would buy electric heating." We agree with him that house heating should be sold at a proper price, but we don't agree that nobody would buy it at that price. There are plenty of people in this country willing to pay compensatory rates for the convenience and other amenities of electric house heating, and it should be good business for the electric utilities to serve the load.

The problem is to provide adequate distribution facilities and to determine compensatory rates for the energy and service. It is a difficult, but not insolvable, problem. Every past development in electric service was a problem in its time. Each one was solved in more or less satisfactory fashion; at least a way was found to live with it. So will it be with electric house heating.

What Makes it Tick

HARDLY ANY COMPANY has failed to prepare material for press and public distribution when a new power plant is baptized and energized. At the other extreme some companies prepare technical papers for the technical press and the professional societies. These papers usually tell the objectives and the operation in language appropriate for the respective audiences.

But in between these lay and literate extremes are the company's own employees. They live and work in an atmosphere charged with the lingo of the art, but few of the non-technicals have anything but vague conceptions of the terms they hear. They can ge forgiven if they associate some of the expressions with the experiences and asperations of their every day life. Magnetic separator—if two objects are magnetic, why separate them? Did the exciter or the induced draft fan have anything to do with it? The field may have been wide open? Maybe Dr. Sanders should have been followed by a nurse with a deaerator. Transformations are what the beauty shops purvey. Carriers remind you of Typhoid Mary. Would protective relays mean a procession of defenders against the wolves that abound? To the engineer these last few sentences sound like the "smart-aleck comments" of high school students, but so many employees are not engineers.

One company has reacted to this untaught audience more tangibly and permanently than merely to depend on transitory speeches, sound-slides, or movies. A. H. Beiler of American Gas & Electric Service Corp's mechanical engineering division has written a booklet which dispels all these distracting connotations. It is entitled *A Trip Through a Steam-Electric Power Plant* and defines the equipments and their functions in as simple terms as technical rigor will tolerate. It is a running story. The major concepts are boldfaced so as to have the employees see them and sense their relative importance.

In short, there is occasion to clarify the fog about the power plant and tell why it has to be so big, so mysterious, and so complicated. The employees would be glad to know.

The Electrical Week

Common stock financing by electric utilities still is going strong, and yields are down to their lowest level since 1947. The table of yields which usually appears on the Financial Page has been omitted this week because the statistics have been made a part of this story (p 80) . . . Secretary of Interior Chapman has called for more federal hydro power. He urges the development of 30 million kw additional by 1970 (p 81) . . . Interior protests opinion of an FPC examiner that Virginia Electric & Power Co should develop Roanoke Rapids. It has asked a reopening of proceedings so that new evidence can be presented (p 81) . . . The American Public Power Association has gone on record as favoring "wheeling" of federal power by private utilities, but with limitations (p 84) . . . And the Bureau of Labor Statistics reports that wage increases for electric and gas utilities' workers averaged 8½¢ an hour in 1949 (p 85).

• • •

President Truman's Water Resources Policy Commission will hold its next meeting in Washington, April 30–May 2. Latest progress report from Chairman Morris L. Cooke is that WRPC will "deliver the goods."

Los Angeles Department of Water and Power has instituted a thorough inspection of its 15-year-old, 287.5-kv transmission lines to Hoover Dam. Study of the HH conductor, which supplies the city with 75% of its energy, followed discovery of the first segment failure. Later checking, now 55% completed, revealed eight failures. Vibration dampers are being installed as an initial corrective step.

SEC-Department of Commerce estimates place expenditures on new plant and equipment by electric and gas utilities for 1950 at $2,940 million, down from 1949's $3,140 million. First quarter 1950 estimate is now $740 million, second quarter, $810 million.

President Truman, March 21, signed consent by Congress to the compact between Idaho and Wyoming for division of waterflow in the Snake River. It helps clear the way for Congressional authorization of 30,000-kw Palisades Dam.

Reclamation would like to begin negotiations for sale of Missouri Basin power to that big preference customer, Nebraska. But Nebraska's public power situation is so confused that the federal agency doesn't know with whom to negotiate.

Gov Sherman Adams of New Hampshire has declined entering the current rate case of the Public Service Co of New Hampshire as a witness for the utility's opponents. He said that he has no expert knowledge of utility operation and added that the attorney general had ruled him exempt from subpoena.

Look for early announcement of a federal power sale agreement between Colorado Public Service and Reclamation. It will cover power coming in at Colorado-Big Thompson project dams this year.

By the end of 1951 New England Electric System expects to have 165,000 television sets in customers' installations. Probable peak at 9 pm is likely to add 25,000 kw to the demand, consumption of this service reaching 37,000,000 kwhr per year and adding $1.3 million to gross revenues.

Forty-five tons of uranium U-235—a 4-ft 3-in. cube—could supply all the electric power used in this country for a year, C. P. Cabell of General Electric Co's Project Engineering Divisions said recently at Richland, Wash.

Notes From The News

TVA has placed in operation the 18th and last generating unit at Wilson Dam to bring total capacity to 436,000 kw . . . The Niagara Mohawk Power Corp blamed a rat for cutting off power to nearly half of Utica, N. Y., March 29 for 8 to 15 minutes. The rat caused a short circuit in a high voltage line at a substation outside the city . . . Governor Dewey of New York has approved a bill increasing the daily allowance for trustees of the State Power Authority from $75 to $85, with maximum annual of $8,500 instead of $7,500. He also signed a bill raising the salaries of Public Service Commissioners from $15,000 to $16,500 and the chairman's salary to $17,500 . . . Kentucky Dam on the Tennessee River near Paducah attracted 1,204,176 visitors last year. This was more than the attendance at any national park except the Great Smokies . . . The Santa Barbara City Council has accepted an offer to sell its municipal airport electrical distribution system to Southern California Edison for $35,000 . . . An exchange of electric facilities located in eastern Indiana by Indiana & Michigan Electric Co, Fort Wayne, and Public Service Co of Indiana, Indianapolis, has been authorized by the FPC.

Stock Offerings High in 1st Quarter

Yields on Electric Utility Common End Period at Low Since Fall of '47; Bond Return Stable Despite Pressure of Federal Reserve Selling Policy

COMMON STOCK financing by electric utilities still is going strong, with yields down to their lowest level since 1947.

Electric operating companies offered the public an estimated $128,990,000 in new money common during the first quarter of 1950, more than a third the amount sold in the entire near-record year of 1949 (see table for revised totals). And yield on first quality common, based on ELECTRICAL WORLD's index of ten operating electric stocks, stood at 5.22% on March 30. Though up from the quarter's low reached in the week of March 16, this figure still was below any quarter-end yield since the fall of 1947.

Second quality common was yielding 5.85% on March 30, lowest since June, 1947, and third quality yield was 6.51%, a low since the end of 1946.

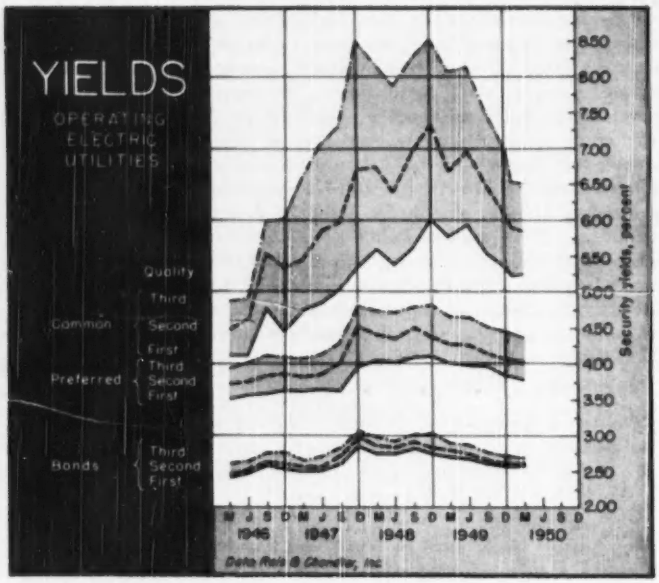
Public Security Offerings
Electric Operating Utilities
(Totals Estimated in Thousands of Dollars)

	New Money	Other	Total
FIRST QUARTER OF 1950			
Bonds			
Mortgage	$86,250	$36,500	$122,750
Debentures	49,000		49,000
Convertible			
Preferred Stock			
Non-convertible	61,802	30,413	92,215
Convertible			
Common Stock	128,990	43,348	172,338
YEAR 1949			
Bonds			
Mortgage	626,747	216,790	843,537
Debentures and Notes	81,550		81,550
Convertible	25,064		25,064
Preferred Stock			
Non-convertible	185,754	7,387	193,141
Convertible	23,400		23,400
Common Stock	356,009	176,404	482,413

Electric utilities thus seemed to be taking full advantage of a booming stock market which pushed the Dow-Jones utility average from 41.20 on Dec 29, 1949, to 43.5 at the end of March.

The favorable market for utility securities, stronger in recent months because of uncertainties in industrials, seems likely to continue. In the first quarter of this year 11 major operating companies announced dividend increases. Only one made a slight reduction, and that might be made up at the end of the year.

Another development is likely to improve the position of sellers of common. A bill passed at the last session of the New York State Legislature permits trustees to make "prudent" investments in common stock.



In contrast to common stocks, the most striking feature of electric utility bond yields during the first quarter was their immobility. Yield on first quality bonds closed on March 30 at 2.59%, exactly the level of Dec 29, 1949. Second quality bonds also were unchanged at 2.61%, and even third quality bonds dropped in yield only from 2.72% to 2.71%. This stability was maintained in the face of the government's policy of holding down prices of Treasury bonds.

Yield to call on long-term United States Treasury bonds rose from 2.24% at the end of December to 2.34% in late March. This was largely the result of sales of long-term Treasury bonds from the Federal Reserve portfolio, resumed during the quarter to check any possible boom psychology in the bond market.

The stability of utility bond yields is especially striking against a rising stock market and a relatively heavy volume of financing. It has helped encourage the moderate return to refunding which began late last year in bonds and recently has spread to preferred stocks.

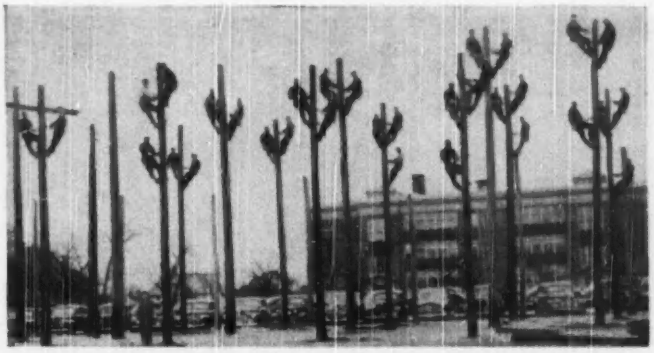
Volume of new money bond financing so far this year has not been great, an estimated $135,250 as compared to a revised figure of $708,297, excluding convertibles, for 1949. Preferred stock is holding up well, an estimated $61,802 in new money, one third the revised 1949 total of $185,754, excluding convertibles.

Preferred yields have followed the common trend, though less sharply. Yield on first quality preferred during the quarter fell from 3.85% to 3.78%; second quality from 4.06% to 4.01%; and third, from 4.46% to 4.36%.

•

Will Tie In with Utility

Because of a succession of power breaks, the Penn Yan Municipal Board has decided to tie in a part of the village electric lines with outside energy sources. The board voted to turn over to New York State Electric & Gas Corp a portion of its power load in the eastern side of the business section of the village and areas adjacent to it.



NOT CACTI are these but apprentice linemen at class at the school conducted by the Narragansett Electric Co at Providence, R. I. The man on the ground is an instructor

Chapman Proposes U.S. Develop 30 Million Kw More Hydro by '70

FIVE-FOLD INCREASE in federal hydroelectric development within two decades is needed to "meet the long-range energy requirements of the economy", declares Secretary of the Interior Oscar L. Chapman. This bold program is called for in the department's centennial report covering fiscal year 1949, ended last June 30.

Secretary Chapman urges federal development of 30 million kw more of hydro capacity by 1970. Thus far, he says, we have developed only a fifth of the hydro capacity in our rivers. Yet to be developed are some 77 million kw.

Chapman's views are stated in a letter of transmittal with the report which covers a period in which he was Undersecretary of Interior.

During Interior's centennial year, the Department's Division of Power reported total power sales of 22.6 billion kwhr with revenues of $53.7 million. Revenues were up 20.3% over fiscal '48, and generation increased 15.5%.

Interior's biggest power agency was the Bureau of Reclamation which had in operation 17 power plants with a total installed capacity of 2,757,400 kw. During the fiscal year, Reclamation had ten new plants with an ultimate capacity of 892,100 kw under construction.

Despite this huge program, Reclamation Commissioner Michael W. Straus reported, "the Western states in general are deficient in electric generating capacity."

Mineral resource developments "have been deferred due to lack of adequate source of power," Straus charged.

In support of his findings, the commissioner said that applications for power from Davis Dam, which will come in late this year on the Lower Colorado River, were nearly four times as great as the firm capacity output.

During fiscal '49, Reclamation sold 18,144,000,000 kwhr for a record high of $32 million. More than 9 billion kwhr and $9 million were chalked up from sale of power to Bonneville Power Administration which markets power from bureau projects on the Columbia River.

BPA also broke all records in sales for the fiscal year. Gross operating revenue was $27,821,000, with total generation of 12,925,788,000 kwhr. Installed capacity in '49 at the two plants from which BPA markets power, Bonneville and Grand Coulee, was 1,598,400 kw nameplate and 1,764,000 kw under favorable operating head conditions.

Southwestern Power Administration sold the output of single 35,000-kw units at two dams, Denison, Texas, and Norfolk, Ark. During fiscal '49 revenues were $1,661,132—$865,184 from Norfolk and $795,948 from Denison.

First beginnings of what has recently been formalized as the new Southeastern Power Administration are noted in the report. Dale Hollow Dam power came in during December 1948 and produced 92 million kwhr up to June 30, 1949. This power was sold to TVA by the division of power for an estimated $300,000. Since the period covered by the report, Southeastern Power has contracted for sale of power from two more plants.

Interior Asks Reopening of Roanoke Rapids Case

New delays loom in the Roanoke Rapids case at the Federal Power Commission.

Department of Interior has filed two motions which would:

1. Suspend a 20-day time limit for filing exceptions to the presiding examiner's initial decision.

2. Reopen the proceedings to require a new report from the examiner and to permit introduction of new evidence.

Vepco Approved by Examiner

Development of the Roanoke Rapids site by the Virginia Electric & Power Co was approved March 20 by FPC's chief presiding examiner, Frank A. Hampton (EW, March 27, p 76).

Interior's motion to reopen the case asks that the initial decision be sent back to the examiner. It "falls far short of its purpose," the motion charges.

In addition, Interior wants to introduce new evidence on four points. The new evidence would consist of:

1. Studies now being made by Interior's Division of Power. The studies will show, the motion states, that the Secretary of Interior will have a "ready market" for Roanoke Rapids power by 1958.

Buggs Island a Factor

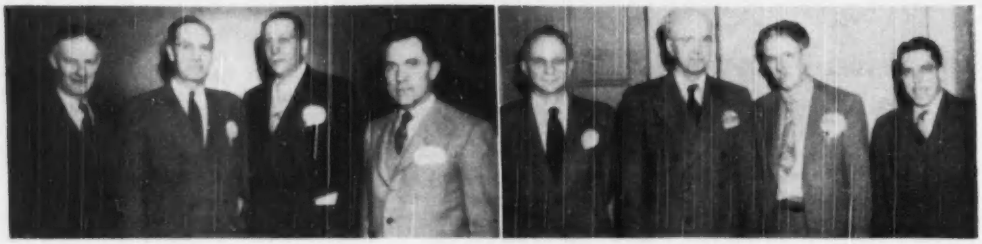
2. Testimony by new Southeastern Administrator Ben W. Creim concerning operation of Bugggs Island Reservoir, upstream from the Roanoke Rapids site, in connection with the proposed new development. Buggs Island, now under construction by the Army Engineers, will be within the power marketing area of the new Southeastern Power Administration.

3. Facts concerning headwater benefit payments which would be assessed by the government against private operation of a Roanoke Rapids plant because of the Buggs Island construction. Contribution of the upstream project, in terms of power value, is estimated in the motion to be equivalent to $1,762,000 per year. Such a charge would make Roanoke Rapids power more costly than steam power, it is stated.

4. More facts to support arguments that the proposed Vepco development would interfere with navigation on the Roanoke River.

In asking for the time limit suspension, Interior pointed out that the 20-day rule would automatically be dropped if the motion to reopen is granted. If the reopening is denied, Interior wants more time to file exceptions to the initial decision.

PRESIDENT of Missouri Valley Electric Association and committee chairmen: Left to right, President D. S. Kennedy; Dr Jack T. Wilson, Allis-Chalmers Manufacturing Co; J. S. Wantland, general chairman, Technical Committee. In right panel, Walter Moeller, vice-chairman, Meter Committee; E. J. Drewelow, vice general chairman, Technical Committee; and J. W. Blake, vice chairman, Prime Movers Committee



PROMINENT personalities at Missouri Valley Electric Association Engineering Conference included J. R. Steele, B. V. Garner, and C. D. Murdock, discussion leaders; and Rex T. Horn, a speaker on the Accident Prevention Committee program. In right panel, E. G. Norell, Sargent & Lundy; J. L. Culhane, vice chairman, and R. W. Johnston, Electrical Apparatus Committee; and M. C. Harmon, S&C Electric Co

Missouri Valley Group Has Varied Program

With a program covering everything from atomic energy to the importance of selling service, the Missouri Valley Electric Association held its 21st annual Engineering Conference, March 29, at Kansas City, Mo. Attendance exceeded 600.

Knowledge of atomic behavior will further understanding of the sun's actions and in the near future the effect of these studies will be seen in long distance power transmission. This was the prediction of Dr Jack T. Wilson, chief physicist, Allis-Chalmers Manufacturing Co. Already relay chatter on long distance lines has been related to solar radiation and disturbances. Scientists now can observe disturbances in the atmosphere surrounding the sun and knowing the time for the effect of these disturbances to reach the earth can accurately predict when relay disturbances will reach certain areas on the earth. Further study of the effect on long distance transmission will be made.

People in the Missouri Valley area don't think that profits are a crime but that any firm must have profits to stay in business. This attitude, said D. S. Kennedy, president of both the association and the Oklahoma Gas & Electric Co, is one of the big reasons for the growing importance of the area in the economy of the country. He urged engineers to look around and see what is going on beyond the realm of their own jobs and advised that they expand their point of view by being with people with other interests.

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Utility Granted Franchise

Louisiana Power & Light Co has been granted a 25-year franchise by Jena officials. It is expected that LP&L rates will be $7,000 a year cheaper than those in effect when the municipal system was operating. Jena will receive 2% of gross residential and commercial revenue.

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Directed to Serve Area

Arkansas Power & Light Co has been directed by the Public Service Commission to furnish electric service for a rural area in southern Stone and Northern Cleburne Counties. A portion of the area was previously allocated to the First Electric Cooperative Corp.

Army Engineers Urge Alaska Power Projects

Construction of power, flood control, and navigation projects in the Cook Inlet area of Alaska at an estimated cost of $50 million has been recommended by the North Pacific division, office of the Corps of Engineers.

The principal power project included in the recommendation provides for construction of a low dam near the outlet of Eklutna Lake 60 mi northeast of Anchorage, a tunnel and penstock to carry water to the Knik River and a power plant with installed capacity of 31,800 kw. Cost of this project is estimated at $25,240,000.

Two other projects in the Kenai peninsula would provide an additional 18,400 kw. These projects, estimated to cost $10,914,000, provide for intake structures, tunnels, penstocks and power plants at Cooper and Crescent Lakes.

The three proposed projects would provide needed power for the Anchorage, Fort Richardson, and Seward region. Transmission facilities and substations required to connect the three power plants would cost an estimated $9,500,000.

PRESIDING at the several parallel work sessions of the annual Spring Conference of the Rocky Mountain Electrical League at Denver were: William J. Quinn, Accounting; Albert Tracy, Adequate Wiring; L. M. Robertson, Engineering; and H. T. Rankin, Sales and Promotion

System Operating Economies Up for Discussion by Mountain League

MANY IMPORTANT factors affecting system operating economies were the center of discussion as the Rocky Mountain Electrical League held its annual spring conference, March 27-28, at Denver.

A half-day session was devoted to design problems of fuel-burning generating plants in the Rocky Mountain area. Average cost of fuel over the entire expected life of the plant plus careful consideration of the projected load and load factor are two of the fundamental elements affecting preliminary design, asserted A. A. Woodward, Public Service Co of Colorado. He observed that load factors in the area do not favor the use of reheat cycles.

J. Y. Parce, Stearns-Rogers Co, warned that longtime availability of a particular fuel should be assured before a boiler is purchased. Otherwise a boiler may be installed that is incapable of handling different grades or a different type of fuel.

Increased operating efficiencies and better manpower utilization, which have helped the industry offset rising costs of fuel and labor, are due in some small measure to automatic control equipment, said G. M. Wallace, Bailey Meter Co. Simple, inexpensive, and reliable automatic equipment to meter, record, and control steam generation now costs from $1.50 to $3.50 per kw of installed capacity.

The need for all such equipment or methods which can help the utilities find a better, less expensive way for providing service was pointed up by J. E. Loiseau, president, Public Service of Colorado. Present earnings on new plant investment are only 3 to 3½%, and every possible operating economy must be realized if the industry is to have satisfactory earnings on new capital. Loiseau also characterized as "the bulwark of those who would socialize industry" the preference clause under which public bodies receive power from federal projects. "It is time", he said, "for the electrical utilities to step out and defend their consumers who are being deprived of the right to buy power from the projects for which they have put up the money."

Paul Jones, Home Gas & Electric Co, reported that his company had found loop feeder circuits more attractive than radial where importance of circuits and continuity of service are important considerations. He recommended a loop with two transformers and a single breaker each, feeding two feeders with a tie breaker between them normally open.

M. H. Powell, Public Service of Colorado, made a plea for adoption by the utilities of EEI standards on crossarms and pole-top hardware. This would allow the manufacturers to cut down substantially on the cataloguing of special items and would result in an appreciable saving to all.

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Texas Taxes Raised

Texas increased taxes on gross receipts of electric utilities 10% on March 1. Other utilities are affected also. The tax, which will be used to support hospitals for mental and tubercular patients, will expire Aug 31, 1951.

Jersey Central P&L Co Will Burn Oil and Gas

Jersey Central Power & Light Co will convert its power plants to burn fuels other than coal. The Raritan River Station, Sayreville, will be converted to burn natural gas during the summer months. The South Amboy Station will be converted to burn oil whenever necessary. Total cost of the changeover will be $500,000.

The company has been using 500,000 tons of coal annually and has been encountering great difficulties because of the continued coal strikes and work stoppages. Since its regular suppliers have been able to furnish but 65% or less of its requirements, the company has been forced to buy coal in the open market regardless of price or quality.

A 1-million gal oil storage tank will be erected at South Amboy.

The Raritan River Station will be connected to a gas line which the company is building to its manufactured gas plant at Long Branch. During the off-peak months 25-million cu ft of gas a day will be burned.

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City to Install Generator

Thomasville, Ga., will install a 5,000-kw generator in its water and light plant. The enlargement was voted by Thomasville residents who approved the issuance of $500,000 in revenue certificates to finance the project. The plant's capacity now is 10,500-kw.

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Granted 33-Year Franchise

The City Council of Milford, Utah has approved a 33-year franchise for Telluride Power Co.

APPA Would Let Utilities 'Wheel' Federal Power

Recognition of a limited role for privately owned electric utilities in transmission of federal power was approved by the American Public Power Association at its annual convention in Washington, March 28-30.

An APPA resolution urged the federal government to construct and own transmission lines "economically necessary for the proper integration and operation" of federal plants. Public agencies and co-ops should have a "preferred right" to build lines from federal plants, APPA decided. However, the resolution continued, contracts should be negotiated for use of "existing" transmission facilities, providing such agreements did not:

1. Result in higher costs than federal construction of lines.

2. Produce any charges to preference customers beyond cost of transmission.

3. Interfere with or alter preference rights of public agencies and co-ops.

4. Call for services beyond transmission.

Advantages of "wheeling" agreements being arranged by Interior power agencies were discussed by Assistant Secretary of Interior William E. Warne. "They make unnecessary the investment of federal funds in transmission facilities, and they give the power company a part in the continuing effort to serve the region," Warne said.

Another APPA resolution called for development of St. Lawrence power "by the federal government or . . . jointly by the State of New York and the Province of Ontario." Pleas for the St. Lawrence project were made by Senator George D. Aiken, Republican of Vermont, and REA Administrator Claude R. Wickard.

APPA endorsed, without specific mention, REA loans for facilities to be operated by the Southwestern Power Administration. Local public development of multi-purpose projects with the federal government paying for non-reimbursable features also was proposed.

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Seeks Co-op Membership

Iowa Southern Utilities Co, Centerville, has applied for a membership in the Eastern Iowa Light & Power Cooperative, Wilton Junction. The application was made so that the utility may receive electric service from the co-op for an estimated four months while Iowa Southern is working on transmission lines affecting Mediapolis.

CHANGES IN CAPACITY REPORTED TO FEDERAL POWER COMMISSION

PLANT ADDITIONS DURING JANUARY

Utility	Plant	Fuel	Capacity (Kw)
Lyndonville Electric Department	Vail, Vt.	H	350
New Jersey Power & Light Co	Gilbert	S	60,000
Duncannon Municipal Light Department	Duncannon, Pa.	IC	280
Duquesne Light Co (Pa.)	Frank R. Phillips	S	65,000
Painesville Electric Light Department	Painesville, Ohio	S	7,500
Tipton Electric Light & Water Department	Tipton, Ind.	IC	3,900
Peru Electric Light & Power Department	Peru, Ind.	S	10,000
Southern Indiana Gas & Electric Co	Ohio River	S	99,000
Flora Light & Water Department	Flora, Ill.	S	3,000
Illinois Rural Electric Co	Pittsfield	IC	3,380
Black River Falls Electric Utilities	Black River Falls, Wis.	IC	985
Dairyland Power Cooperative (Wis.)	Twin Lakes	IC	5,400
Northern States Power Co	Red Wing, Minn.	S	11,500
Manning Municipal Light Department	Manning, Iowa	IC	600
Muscatine Electric & Water Department	Muscatine, Iowa	S	12,500
Iowa Public Service Co	Eagle Grove	S	7,500
Sikeston Board of Public Works	Sikeston, Mo.	IC	2,250
Chelda Electric Light Plant	Chelda, S. D.	IC	200
West Point Light & Water Works	West Point, Neb.	IC	900
Chanute Electric Department	Chanute, Kan.	S	5,000
Monongahela Power Co.	Franklin, W. Va.	IC	80
Tennessee Valley Authority	Wilson Dam, Ala.	H	25,200
Mississippi Power & Light Co	Rex Brown	S	44,000
Southwestern Gas & Electric Co (La.)	Lieberman	S	25,000
Gulf States Utilities Co	Louisiana	S	40,000
Texas Power & Light Co	Trinidad	S	60,000
Robstown Lighting & Power Department	Robstown, Tex.	IC	700
Southwestern Gas & Electric Co (La.)	Knox Lee	S	30,000
Idaho Power Co	Bliss	H	25,000
Jackson (Wyo.) Hole Light & Power Co	Jackson 3	IC	200
Sulphur Springs Valley (Ariz.) Electric Cooperative	Cochise	IC	1,150
Springville (Utah) Municipal Power & Light System	Bartholomew	H	500
Utah Power & Light Co	Moab	IC	136
Fairview (Utah) Municipal Electric Light Department	Lower	IC	50
California-Oregon Power Co	Tuketee Falls	H	14,167
Pasadena Municipal Light & Power Department	Azusa, Calif.	H	3,000

PLANT RETIREMENTS IN JANUARY

Public Service Co of New Hampshire	Goat Falls	S	4,500
Connecticut Light & Power Co	Devon	S	25,000
Jersey Central Power & Light Co	Long Branch, N. J.	S	1,300
Wauseon Board of Public Affairs	Wauseon, Ohio	S	156
Tipton Electric Light & Water Department	Tipton, Ind.	S	1,455
Central Illinois Light Co	Liberty St.	S	3,000
Roseau Water & Light Department	Roseau, Minn.	IC	138
Northern States Power Co	Sunrise, Minn.	H	100
Northern States Power Co	St. Cloud, Minn.	S	4,750
Segelhorst Brothers	Beaufort, Mo.	IC	167
Consumers Public Power District	Bridgeport, Neb.	IC	138
West Point Light & Water Works	West Point, Neb.	IC	150
Monongahela Power Co	Summersville, W. Va.	H	60
		IC	136 (1 unit transferred to Franklin)
Southwestern Gas & Electric Co	Dekalb, Tex.	IC	136
Pasadena Municipal Light & Power Department	Azusa, Calif.	H	1,500
California-Oregon Power Co.	Alturas, Calif.	H	540

H—Hydro, IC—Internal Combustion, S—Steam.
United States Capacity as of Feb 1—Steam, 44,696,709 kw; Internal Combustion, 1, 814,435 kw; Hydro, 16,681,956 kw; Total, 63,193,100 kw.

Pacific G&E May Serve California AEC Project

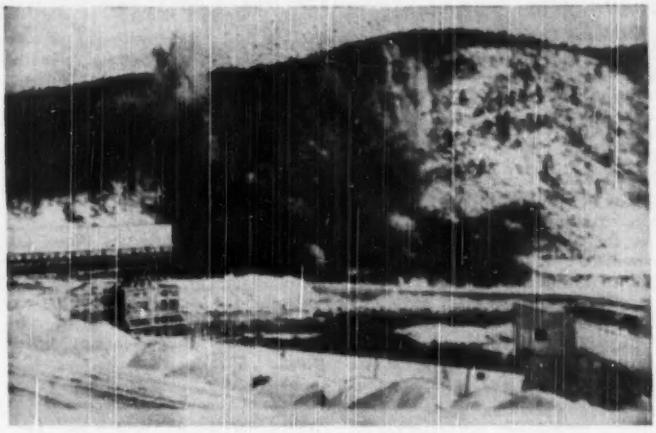
Pacific Gas & Electric Co last week appeared to have snatched a prospective major power customer from the Bureau of Reclamation.

The prospect was the new Atomic Energy Commission research project soon to be built at the Livermore Naval Air Station, Livermore, Calif. Though the power needs of the development were shrouded in official secrecy, authoritative guesses had it that the facility would require as much as 150,000 kw in the next four or five years.

Though Livermore is in the heart of the "Bay area" of PG&E's system, it also is only 25 miles from the Reclamation Bureau's Tracy substation. The bureau is asking Congress this year for a considerable increase in funds for additional generating equipment in the nearby Central Valley of California.

But PG&E has been approached as a possible supplier of energy for the classified project. The bureau has not. PG&E officials, refusing to comment on the matter, pointed out, however, that the company would add 600,000 kw in new generating capacity at its Antioch and Moss Landing steam stations within a year.

AEC has contracted with the California Research and Development Corp, in cooperation with the Radiation Laboratory of the University of California, to operate the Livermore installation. Presumably one of the latter organizations would make arrangements for the project's power supply.



DIVERSION channel is blasted open at the La Cave project of the Hydro-Electric Power Commission of Ontario. The first of six 32,000-hp units is to go into operation in 1952

Utility Wage Increases Averaged 8.5¢ an Hour in 1949, BLS Reports

WAGE INCREASES for electric and gas utilities' workers averaged 8½¢ an hour under collective bargaining agreements last year.

A review by the Bureau of Labor Statistics of 120 wage settlements—for 183,000 utilities' employees—shows increases ranging typically from 4 to 14¢ an hour. More than half the workers received increases of 6 to 10¢.

Only agreements involving 200 or more workers were included in the BLS review.

A large proportion of the settlements resulted in percentage adjustments or a range of increases, instead of flat across-the-board increases. This has been true for several years.

Here is how the increases were divided:

Hourly Increase	Workers Affected
Less than 4¢	1,500
4 to 5.9¢	13,500
6 to 7.9¢	47,000
8 to 9.9¢	70,500
10 to 11.9¢	26,500
12 to 13.9¢	23,000
14¢ or more	1,000
Total	183,500

There were only slight differences in the average increase for each of five regions: Far West, Middle Atlantic, Midwest, New England, and South. All averaged around 8 to 9¢ an hour.

Many workers got both increased wages and additional benefits, particularly longer paid vacations for longer service. There were few changes in retirement and social insurance plans, which have been long established in electric and gas utilities.

Here is a breakdown of the number of workers who received increases in various benefits:

Benefit	Workers Affected
Additional vacation benefits	36,000
Additional paid holidays	8,000
Additional sick leave or benefits	7,000
Additional social insurance benefits	5,000
Additional pension benefits or new plan	9,000
Increased shift differentials	6,000
Classification rate adjustments	8,000

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Commonwealth Offers Labor Relations Service

Commonwealth Services, Inc. has established an industrial relations department to serve clients in matters of employee relations, employee communications, personnel administration, management and employee training, and labor relations. Franklin O. Rouse is in charge of the department, whose headquarters are located at 20 Pine St., New York.

Commonwealth has also announced the opening of an office in Washington. The new office is expected to expedite the Washington work handled by Commonwealth for its clients, particularly in matters concerned with hearings and other work before the Federal Power Commission and the Securities and Exchange Commission.

Watch Engineers Still Not Supervisors, NLRB Says

There is a difference between the watch engineer at Pacific Gas & Electric Co and the control operator at Ohio Power Co. PG&E's watch engineer is not a supervisor; Ohio Power's control operator is, according to the National Labor Relations Board.

NLRB has denied PG&E's request for reconsideration of a ruling last December that watch engineers are not supervisors (EW, Jan 2, p 38). As supervisors, they would have been excluded from the bargaining group recently taken over on a systemwide basis by AFL's International Brotherhood of Electrical Workers (EW, Feb 20, p 13).

PG&E cited the Supreme Court's decision on Ohio Power's control operators. The court reversed an earlier NLRB finding that control operators were not supervisors.

NLRB asserted that watch engineers, who take over from day foremen on the second and third shift, merely transmit the day foremen's orders. They do not themselves supervise. Control operators at Ohio Power direct other workers in emergency situations.

One NLRB member, James J. Reynolds, Jr, disagreed with his colleagues but not on the basis of the Ohio Power decision. Reynolds contended that watch engineers are in fact supervisors because they have a group of workers under them.

A point cited against PG&E was the company's description of the watch engineer's job as being of a supervisory "nature." This, NLRB said, is not enough in itself to establish the existence of supervisory authority which the Taft-Hartley Act requires for exclusion from bargaining rights.

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Vepco Gives 4% Pay Boost

Virginia Electric & Power Co has granted 2,575 production and maintenance employees a wage increase of 4%. Provisions for the raise and other benefits are included in a new one-year contract which will become effective April 1. The 4% increase represents an average hourly pay boost of 5½¢ for Vepco workers in Virginia, North Carolina, and West Virginia.

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Co-op Buys Properties

Central New Mexico Electric Cooperative, Corona, has acquired the Inland Utilities Co properties in Mountainair, Willard, Estancia, Buford, and Moriarity for $485,000.

FINANCIAL

Niagara Mohawk to Cut Rates, Merge Subsidiary

Further steps toward system simplification were taken last week by Niagara Mohawk Power Corp, new upstate New York operating company.

The company asked Public Service Commission permission to reduce on May 1 its electric rates to 228,132 residential and farm users in central and eastern New York. The territory formerly was served by Central New York Power Corp and New York Power & Light Corp. These two companies and Buffalo Niagara Electric Corp were merged to form Niagara Mohawk early this year.

Approval also was sought from regulatory commissions for consolidation of Niagara Falls Power Co with the parent. This would leave Niagara Mohawk with one subsidiary, Canadian Niagara Power Co, Ltd, now a Niagara Falls subsidiary. Niagara Mohawk also asked the Federal Power Commission to redefine its license application for the Niagara Falls hydroelectric project to include therein only the generating facilities.

The limited rate cut applies outside the large cities. It is part of a program to make rate schedules as simple as possible, the company said. Formerly the system had three classes of farm and residential rates; now all would be cut to the large-city residential level. Aggregate annual saving to consumers would be about $500,000, with $4.20 a year the maximum individual reduction.

FINANCIAL BRIEFS

Idaho Power Co stockholders at their annual meeting, May 3, will be asked to approve an increase in the authorized common sock from 900,000 to 1.8 million shares. The company does not expect to sell any additional common this year.

California Electric Power Co expects to raise approximately $2.5 million in new capital next year to finance its expansion program. About half the $5 million 1950 construction cost will be provided from internal sources.

Holders of Iowa Electric Light & Power Co preferred have been offered the right to exchange their stock up to April 12 for 108,834 shares of new 4.80% preferred and 839,628 shares of common. The old preferred is $100 par; the new is $50.

Additional financing is expected from Middle South Utilities subsidiaries later this year. Mississippi Power & Light Co probably will be in the market for $7.5 million and Arkansas Power & Light Co for $6 million.

A $250,000 bond issue to enable Springer, N. Mex., to buy or build an electric utility plant has been approved by the Public Service Commission. Frontier Power Co now serves the town, but its franchise expires in June, 1953.

Stockholders of General Public Utilities Corp will vote May 1 on a proposed charter amendment permitting the company to sell stock without offering prior subscription rights.

Public Service Electric & Gas Co., Newark, N. J., has registered $26 million of first and refunding mortgage bonds, series due May 1, 1980. Proceeds of the issue, to be sold at competitive bidding, will be used for redemption of the company's $26 million of first and refunding mortgage bonds, 3¼% series due 1966.

Iowa Public Service Co and Sioux City Gas & Electric Co, both of Sioux City, Iowa, have ceased to be holding companies, SEC has ruled. The two companies were merged Oct 31, 1949.

Stockholders of Interstate Power Co, Dubuque, Iowa, will vote May 2 on authorization of an issue of 500,000 shares of $25-par preferred stock. The company also is expected to offer $6 million in new money bonds in May or June.

Merger of Ohio Public Service Co into Ohio Edison Co has been approved by the Securities and Exchange Commission. Stockholders will vote on April 12 and April 27. The Ohio Public Utilities Commission gave its okay last month.

MEETINGS

American Society of Mechanical Engineers
Spring Meeting, Hotel Statler, Washington, D. C., April 12-14; Semi-annual Meeting, Hotel Statler, St. Louis, Mo., June 19-23.

Southeastern Electric Exchange
Annual Conference, Greenbrier Hotel, White Sulphur Springs, W. Va., April 12-14.

Northwest Public Power Association
Semi-annual Convention, Davenport Hotel, Spokane, Wash., April 17-19.

Edison Electric Institute
Meter and Service Committee, Netherlands-Plaza Hotel, Cincinnati, Ohio, April 17-19; Industrial Relations Committee, Netherlands-Plaza Hotel, Cincinnati, Ohio, April 20; Industrial Relations Committee, Purchasing and Stores Committee, Schroeder Hotel, Milwaukee, Wis., April 24-26; Prime Movers Committee, Hydraulic Power Committee, Accident Prevention Committee, Edgewater Beach Hotel, Chicago, Ill., May 1-2; Electrical Equipment Committee, Edgewater Beach Hotel, Chicago, Ill., May 2-3; Transmission and Distribution Committee, Cosmopolitan Hotel, Denver, Colo., May 25-26; Annual Convention, Auditorium, Atlantic City, N. J., June 5-7.

Indiana Electric Association
Young Men's Utility Conference, Ilpaco Hall (Indianapolis Power & Light Co), Indianapolis, Ind., April 18-19.

* **Public Information Program**
Mid-Atlantic Regional Meeting, Barclay Hotel, Philadelphia, April 19; Steering Committee, Sheraton Hotel, Chicago, May 10; National Meeting, Sheraton Hotel, Chicago, May 11.

Electrochemical Society
Annual Convention, Statler Hotel, Cleveland, Ohio, April 19-22.

American Institute of Electrical Engineers
Power Conference, sponsored by Committee on Power Generation, Industrial Power System, and System Planning, William Penn Hotel, Pittsburgh, Pa., Power Generation, April 19; Industrial Power System, April 20; Northeast District Meeting, Sheraton-Biltmore Hotel, Providence, R. I., April 26-28; Great Lakes District Meeting, Hotel Hayes, Jackson, Mich., May 11-12; Conference on Telemetering, Benjamin Franklin Hotel, Philadelphia, Pa., May 24-26; Summer General Meeting, Huntington Hotel, Pasadena, Calif., June 12-16.

Tennessee Valley Public Power Association
Annual Convention, Andrew Jackson Hotel, Nashville, Tenn., April 20-21.

Pennsylvania Electric Association
Accounting Conference, Benjamin Franklin Hotel, Philadelphia, Pa., April 24-25; Industrial Committee, Industrial Power Conference, Bedford Springs Hotel, Bedford, Pa., May 2-3; Prime Movers Committee, George Washington Hotel, Winchester, Va., May 11-12; Meter Committee, Hotel Bethlehem, Bethlehem, Pa., May 17-18; Systems Operation Committee, Spring Meeting, Skytop Lodge, Skytop, Pa., May 18-19; Transmission and Distribution Committee, Spring Meeting, Alexander Hotel, Hagerstown, Md., May 25-26; Joint Meeting, Traffic Safety Committee, May 26.

Northwest Electric Light & Power Association
Engineering & Operation Section, Vancouver Hotel, Vancouver, B. C., April 26-28.

Oklahoma Utilities Association
Annual Convention, Biltmore Hotel, Oklahoma City, Okla., May 4-5.

Interstate Power Club of New York
Hotel Martinique, New York City, May 8.

Commercial and Industrial Electrical Exhibit
Sponsored by Electrical Manufacturer's Representatives Association of Michigan, Convention Hall, Detroit, Mich., May 10-12.

Public Utilities Advertising Association
Annual Convention, President Hotel, Kansas City, Mo., May 11-12.

New Jersey Utilities Association
Annual Spring Conference, Seaview Country Club, Absecon, N. J., May 12.

Missouri Valley Electric Association
Annual Meeting, President Hotel, Kansas City, Mo., May 16; Accounting Conference, President Hotel, Kansas City, Mo., May 18-19.

Pacific Coast Electrical Association
Annual Convention, Mapes Hotel, Reno, Nev., May 31-June 2.

National Association of Electrical Distributors
Annual Convention, Convention Hall, Atlantic City, N. J., June 12-16.

Canadian Electrical Association
Annual Convention, Manoir Richelieu, Murray Bay, Que., Canada, June 15-19.

American Society for Testing Materials
Annual Meeting with Exhibit of Testing Apparatus and Related Equipment, Chalfonte-Haddon Hall, Atlantic City, N. J., June 26-30.

* Additions This Week.

Missouri Basin Power Rate: 5.5 Mills per Kwhr

Power from federal dams being constructed in the Missouri Basin will be sold at rates averaging 5.5 mills per kwhr.

Rate schedules for Missouri River Basin power have been okayed by Secretary of Interior Oscar L. Chapman. Actual monthly rate schedule for firm power was set at 75¢ per kw of billing demand, plus 3.5 mills per kwhr for the first 250 hours of monthly demand, and 3 mills per kwhr for the balance.

"At the load factor anticipated in the area," Secretary Chapman explained, the "average revenue from firm power will be 5.5 mills."

The new schedules will be applied to a marketing area covering North and South Dakota, central and eastern Nebraska, western Iowa and western Minnesota. A first block of 300,000 kw of federal hydro power is expected to become available about the spring of 1955 at Garrison Dam in North Dakota and Fort Randall Dam, South Dakota.

The new rate schedules are "of the same general form and level" of rates now in effect at Fort Peck Dam in Montana, Secretary Chapman said.

Reclamation Commissioner Michael W. Straus predicted that establishment of the new schedules will "greatly assist" in early conclusion of negotiations of contracts for wholesale power sales. Two contracts already have been signed with two electric utilities in the area, and at least six more contracts with companies are being negotiated.

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5.5 Billion Kwhr Bought by REA Systems in 1949

Power purchases by systems financed by the Rural Electrification Administration jumped to 5.5 billion kwhr during the fiscal year 1949, ended last June 30.

REA's latest compilation showed a gain of one-third in power purchases over the previous year and that five times as much power was bought by REA systems as in 1942. Average cost per kwhr was 8.9 mills, the same as in fiscal '48 and .5 mills under the 1942 average of 9.4 mills.

Total purchases were 5,536,447,133 kwhr, which cost REA borrowers $49,506,630. In fiscal '48 purchases totaled 4,151,635,089 kwhr at a cost of $37,014,736.

During the last fiscal year 58% of the power came from commercial suppliers, 36% from public agencies, and 6% from REA borrowers.

Commercial suppliers were paid an average rate of 10.2 mills per kwhr in 1949, compared with 10.1 mills in 1948. Public agencies, REA said, received an average of 6.7 mills per kwhr, a decline from 6.9 mills in the previous year.

REA reported lowest power costs were found in Washington, Oregon, Nevada, Idaho and Tennessee; highest costs were found in Maine, New Hampshire, Delaware, Wisconsin, Minnesota, the Dakotas and Arizona.

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Utility, City Sign Contract

Auburn, Ind., officials have signed a new 10-year contract with Indiana & Michigan Electric Co in order to improve service and provide reserve. The power company has been providing 2.4-kv but under the new contract will provide 33-kv service. The new contract also provides for a new rate for the city.

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Spencer Starts PUC Job

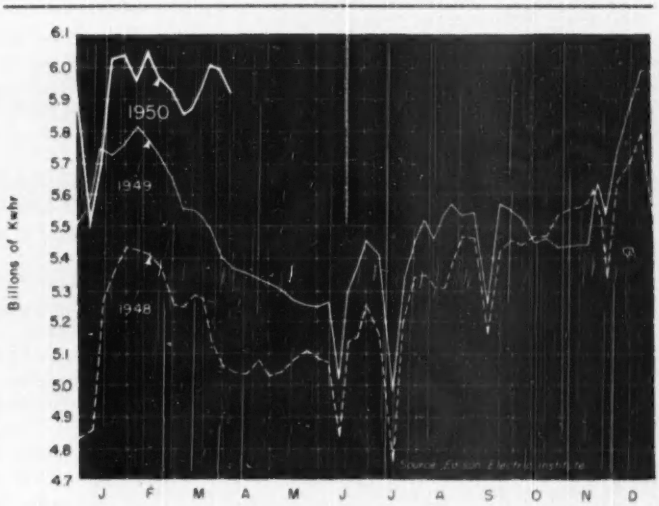
Kenneth W. Spencer has been sworn in as a new member of the District of Columbia Public Utilities Commission, following Senate approval of his appointment by President Truman.

Keswick Unit Completes Central Valley Project

The last generator at Keswick Dam in California went on the line March 31, marking completion of the primary hydroelectric facilities in the Bureau of Reclamation's Central Valley Project.

The 25,000-kw unit at Keswick was started with a long-distance phone call made by Representative Claire Engle, California Democrat, from the office of the Assistant Secretary of Interior William E. Warne. It brought Central Valley power to 450,000 kw, 75,000 at Keswick and 375,000 kw at Shasta, nine miles upstream on the Shasta river from Keswick.

Although this completes the original power plan for Central Valley, Interior will be marketing power from dams now now under construction and hopes to get Congressional approval for more. Folsom Dam is now under construction by the Corps of Engineers, and Interior, through the Reclamation Bureau, will have an estimated 165,000 kw from this development about 1954. In addition, Interior is seeking authority to develop power on the Kings River, but this is being fought by Pacific Gas & Electric Co and the Fresno Irrigation District.



Output Week Ended April 1—5,911,936 Kwhr

Weekly Output, Millions Kwhr

1950		1949		1948	
Apr 1	5,992	Apr 2	5,378	Apr 3	5,037
Mar 25	5,993	Mar 26	5,404	Mar 27	5,065
Mar 18	6,015	Mar 19	5,496	Mar 20	5,145
Mar 11	5,937	Mar 12	5,531	Mar 13	5,285
Mar 4	5,879	Mar 5	5,552	Mar 6	5,293
Feb 25	5,854	Feb 26	5,559	Feb 28	5,252
Feb 18	5,931	Feb 19	5,650	Feb 21	5,254
Feb 11	5,971	Feb 12	5,722	Feb 14	5,385
Feb 4	6,062	Feb 5	5,778	Feb 7	5,412
Jan 28	5,972	Jan 29	5,810	Jan 31	5,429
Jan 21	6,041	Jan 22	5,769	Jan 24	5,436

Percent Change from Previous Year

	Apr 1	Mar 25	Mar 18
New England	+14.9	+14.5	+12.9
Mid-Atlantic	+ 8.2	+ 9.3	+ 6.7
Central Industrial	+ 9.4	+ 9.5	+ 7.1
West Central	+ 8.9	+10.3	+ 8.9
Southeast	+12.2	+11.6	+12.1
South Central	+11.8	+11.5	+11.4
Rocky Mountain	+ 8.7	+ 9.5	+ 8.9
Pacific Coast	+ 9.2	+13.9	+12.9
Total United States	+ 9.9	+10.9	+ 9.5

WASHINGTON COMMENT

RONALD D. ROSS

THERE'S A BIT of irony in the most recent cry of anguish over the threat of federal power expansion.

Investment in existing power facilities will be "jeopardized by competition and duplication from federal agencies." That warning comes now from a spokesman for public power, from the "public power state" of Nebraska.

R. L. Schacht, general manager of Nebraska's Consumers Public Power District, presented this view at the meeting of the American Public Power Association in Washington recently. His frank statement confirmed reports that Interior's Bureau of Reclamation has been wrangling over Missouri Basin power with Nebraska's public power systems, which potentially are major purchasers of this energy.

By 1954, first power units will be operating at three big Missouri Basin projects. One of them, Fort Randall in South Dakota, is almost within walking distance of Nebraska. And Nebraska's public power system makes that state one big preference customer. It seemed so likely that Nebraska would get the lion's share of federal power from the Missouri River projects that South Dakota's legislature held a special session to legalize establishment of public power districts in that state. This was a desperate effort to prevent Nebraska from taking the bulk of power produced at projects being built in South Dakota. Interior is eager to get its initial commitments for Missouri Basin power. It has signed contracts with two private companies and an electric cooperative in the Dakotas. But, thus far, the bureau and Nebraska officials have agreed on only one point: their negotiations are not getting anywhere.

Federal officials say they cannot do business with Nebraska until it gets its own intrastate difficulties straightened out. If Nebraskans can't agree with each other on how to get Missouri Basin power, Interior says it will step in.

Secretary Chapman bluntly told a Grand Island, Nebr., audience in January that "one way or the other—through your transmission lines or through federal lines—we must make it possible for thousands of Nebraskans to share the benefits of low-cost public power from these federal plants."

Behind this threat to build federal transmission lines into Nebraska lie confusion and dissension in the "public power state." In addition to Consumers Public Power District, primarily a wholesaling agency, and Nebraska Public Power System, mainly generation, there are REA-financed co-ops and municipal systems. The most serious differences exist between the big power districts and the municipal systems.

The cities and towns qualify under law as preference customers in the sale of federal power. They want to get their wholesale energy supply at the lowest possible cost. They would be delighted to have Reclamation build lines to serve them directly if the net wholesale cost were lower than that charged by the power districts.

But the power districts want to buy a block of Missouri Basin power and wholesale it throughout the area served by their lines at a single cost-of-service rate. Apparently, the rate offered to the municipals so far has been higher than they would have to pay Interior to bring the energy to them.

The power districts obviously resented Interior's unveiled threats to do just that. Such threats must have weakened the districts' bargaining position in the negotiations with municipals.

Regardless of the final outcome in Nebraska, it is significant that even from that region now rises the cry of unfair "competition and duplication" from the federal government.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Coal stored to guard against disturbances of the mining industry amounts to 50¢ per year extra on the electric bill of every residential customer independently of changes in miners' wages and freight rates. Investment charges on the $160,000,000 worth are $16,000,000, and it costs at least $2,500,000 more to place the 20,000,000 tons on the piles and reclaim them.

Spare parts should be on hand before beginning any sizeable overhaul job; down-time should not have to be prolonged to await delivery of repair items.

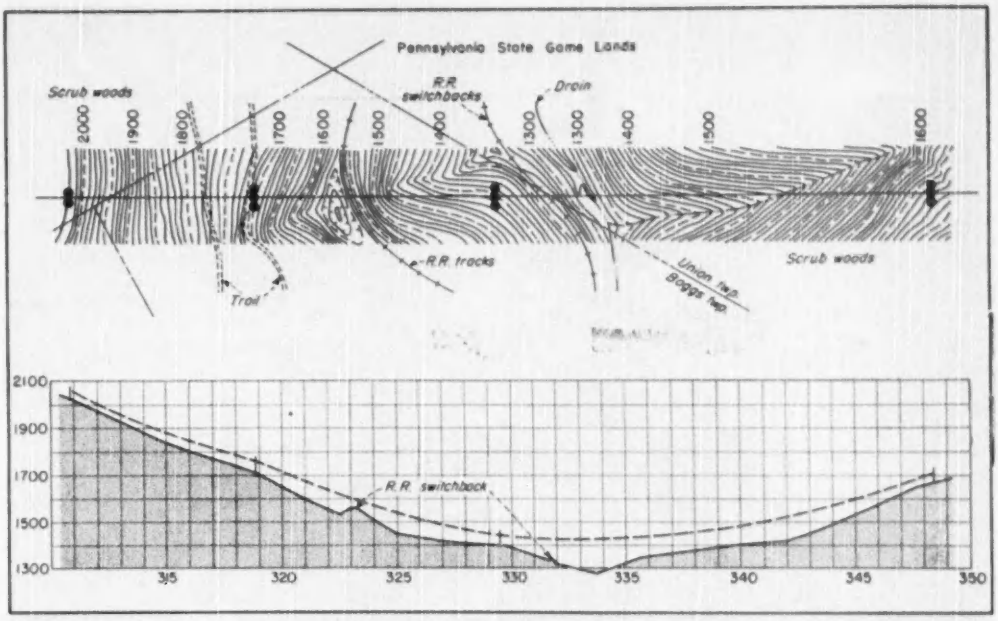
Rust-resisting paint is being used successfully on the inner surfaces of turbine lubricating-oil reservoirs, and even the inside of piping has been similarly protected.

Non-flammable liquid stands in a 12 to 88 ratio with oil as coolant in network transformers (kva basis).

Divided water boxes facilitate condenser cleaning because one-half can be cleared of deposits while the other serves the turbine at partial load.

Pneumatic brushes for cleaning bolts and flange-joint surfaces help expedite turbine overhaul.

Coal piling and reclaiming with mobile earth-moving equipment is being done by one company for 11.2¢ per 1,000 ton-ft in labor, fuel and maintenance; by another at equipment-investment costs of 4.6 to 4.9¢ per ton to store and 5.8 to 7.7 to reclaim.



PLAN AND PROFILE developed from aerial photographs by Kelsh Plotter. Drawing (above) is copy of original print which was drawn to scale of 400 ft-1 in. To insure an accurate profile for field use, print was enlarged ten times. Profile and plan delivered to West Penn Power Co was 40 ft-1 in., horizontally and vertically, with profile plate lined in 10-ft horizontal divisions and 2-ft vertical divisions

Aerial Profiling of 132-Kv Line Cuts Engineering Cost in Two

Transmission line over mountains and through forests, accurately profiled from aerial photographs. Construction completed 13 months after authorization at 50% of usual engineering cost

G. B. HOFFMAN
Civil Engineer
West Penn Power Co
Pittsburgh

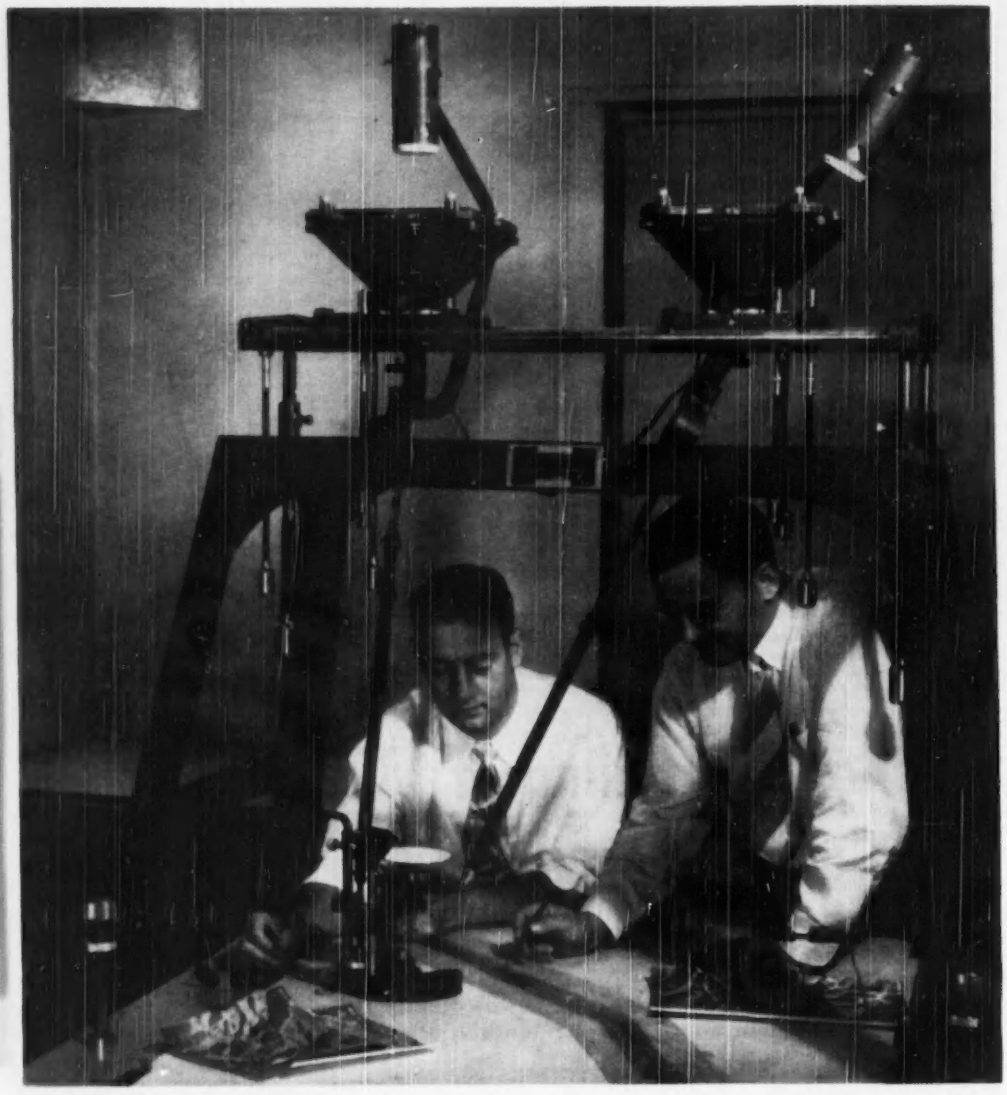
ON January 1, 1950, exactly 13 months from the day of authorization, West Penn Power Co put its new 132-kv Ridgway-Milesburg line into operation—a line built through mountainous forest country long considered "too rugged for practical construction." The story of this line is inseparably linked with a new method of line profiling which:

1. Cut the engineering cost in two.
2. Saved a year's time in survey work.
3. Required only one survey crew on the job.
4. Permitted construction three months after the line was authorized.
5. Established grade on the entire line even before portions of it had been entered.

These benefits were made possible by the use of a new aerial photography technique that yields topographical and profile maps with 10-ft contours and a guaranteed accuracy of ±5 ft. The maps themselves are plotted mechanically by means of a Kelsh Plotter. This device uses overlapping photographic plates and filtered light to determine the relative elevation of points on aerial photographs (see ELECTRICAL WORLD, Oct. 22, 1949, p 98).

Late in the spring of 1948, discussions were started on the necessity for, and feasibility of, a 132-kv transmission line from Ridgway to Milesburg, in Pennsylvania. These points are approximately 62 miles apart, separated by long stretches of mountainous, uninhabited, inaccessible forest land. Formerly, rumors of

Based on a paper presented before the Transmission and Distribution Committee of the Pennsylvania Electric Association



KELSH PLOTTER uses filtered light to produce contour map of right-of-way from aerial photographs. Overlapping photographic plates in holders atop machine are focused to form image which is projected onto movable platten. Operator wearing bi-colored glasses views three-dimensional image. He adjusts platten at desired elevation and then moves it horizontally so as to develop the contour line

such a line always died with the same obituary—the terrain won't permit practical construction. However, this time there was real life to the project.

Picking The Route . . . Our first step, the choice of a route, was solved by air reconnaissance. In July, 1948, the author flew the proposed line in a helicopter to pick the route that offered the least physical resistance. A report on the possible route was turned over to the system planners who, six months later (December 1, 1948) announced that not only would the line be built but also that it must be completed by December 31, 1949—13 months hence.

Time required for such civil engineering functions as surveying and grading was the key to when we would start construction. However, two years' work lay ahead, plus the extra problem of maintaining the men in this rugged country. No distribution maps were available for much of the territory, as approximately 35 miles of the route are outside the limits of our chartered territory. In addition, we did not have enough

survey crews available to keep up with our current work, much less put four or six crews on this job.

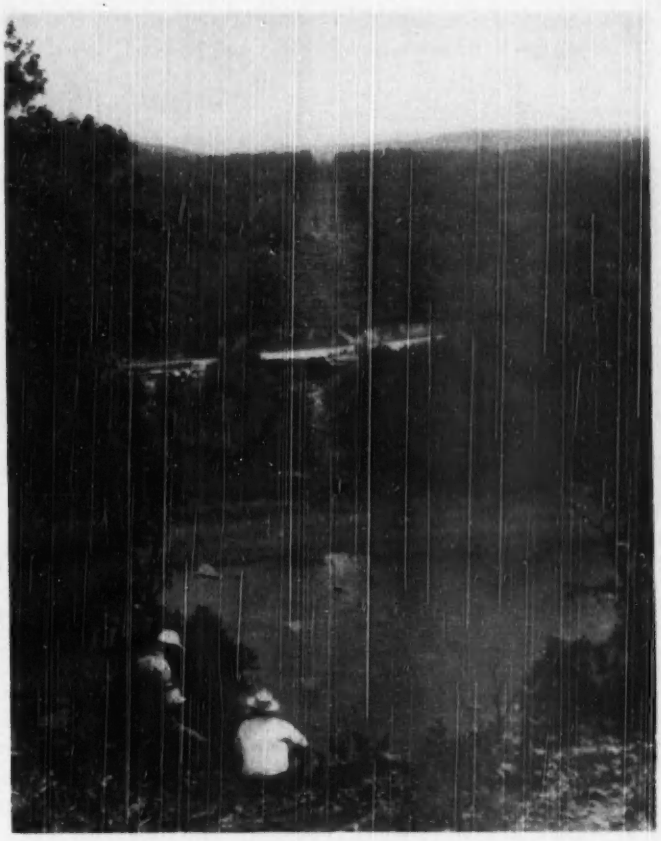
Air Survey Chosen . . . Obviously, conventional civil engineering methods were not for this project. The only possible chance we could see of meeting our deadline was by the all-out use of aerial surveying for mapping and profiling. An aerial photography firm was found who would tackle the job, although they confessed that profiling a transmission right-of-way would be a new application of photogrammetry.

The proposed center line was marked on U. S. Dept of Agriculture aerial photos and agents were sent out to purchase the necessary right-of-way. When sufficient land had been secured, we actually started to lay out the center line on the ground.

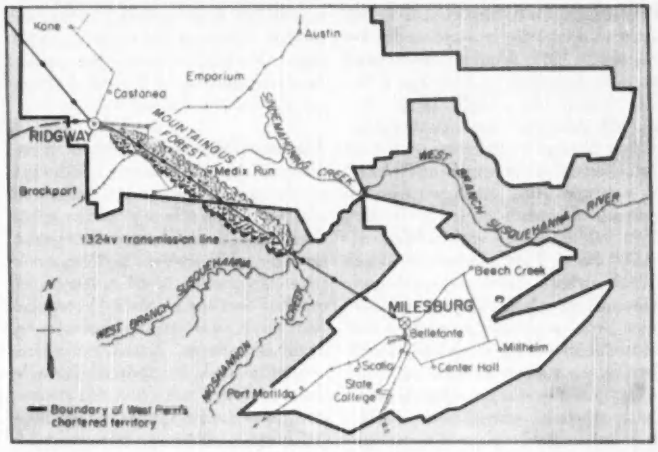
Here we hit our first snag. Aerial mapping does not eliminate *all* ground surveying. From the air we obtain all the data which we normally get from the ground survey. But to build a power line you must have construction stakes in the ground. Now we had to lay the lines on the ground in the same location we had them on the pictures. This would not be too difficult in open country but in this wilderness, when we got on a hilltop, all we could see was the tree five feet in front of us.

Searchlight Survey . . . Since we had already discarded normal routines we ignored tradition again by doing our surveying at night. (See ELECTRICAL WORLD April 23, 1949, page 87). We picked points on the line that could be positively located on the ground. Wherever possible we used angle points or other control points in the line, with particular emphasis on high elevations.

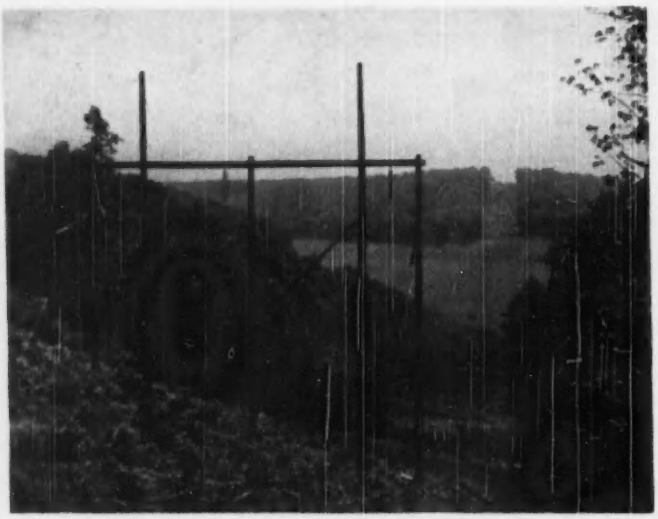
From the aerial survey engineers we learned that, if they were to provide us with an accurate profile along our actual survey center line, we would have to provide accurate information as to the location of our center line on their aerial photographs. But between the Susquehanna River and Ridgway, there were long stretches where our photographs showed practically nothing except uninterrupted forest areas, in which there appeared to be no features to which we could tie our center line.



RIVER CROSSING over West Branch of Susquehanna is 1,513-ft span suspended on three-pole, deadend structures. Although heavily wooded, this section was relatively accessible



FROM RIDGWAY TO MILESBURG—62 miles of line cut through forests and over mountains. Between the Susquehanna River and Medix Run, hunting trails were used as roads



SPAN OF 2,206 FT at Gum Stump required five-pole, deadend structures. Over 30 miles of line were strung over terrain at least this rugged; 50 miles were cut through woods

To overcome this difficulty, we cut the timber and brush from a 100-ft square at each angle point before the survey flight was made.

At the time the survey flight was made, much of the survey center line had been cut through. To our amazement the survey center line, which averaged less than three feet in width, was prominently visible on the picture taken from an altitude of almost 15,000 ft. The problem of identifying the center line on the pictures was nicely solved.

Profile In One Month . . . The picture-taking flight was made on March 29, 1949. First section of profile was delivered on May 2 and the last section one month later. We learned that, to insure an accurate profile, photographic flights should be made when trees are not in leaf. Also, to produce 10-ft contours with a guaranteed accuracy of ±5 ft, the flight was made at a basic altitude of 14,700 ft. A flight made at a lesser altitude would have produced correspondingly closer spaced contour lines with a better accuracy, but would be more expensive and would require more time for plotting.

The profiles were prepared by a Kelsh Plotter, which uses aerial photographs that overlap one another by at least 55%. In operation, glass plates of two adjacent photographs are focused to form a single image and then projected by filtered light onto a movable platten. An operator wearing bi-colored glasses observes a minute spot of light and adjusts the platten until the light appears to rest on the surface of the ground. Having set the platten by means of a point of known elevation, the operator moves the platten horizontally to follow the chosen contour line. The resulting contour is traced on a plastic film as the platten is moved.

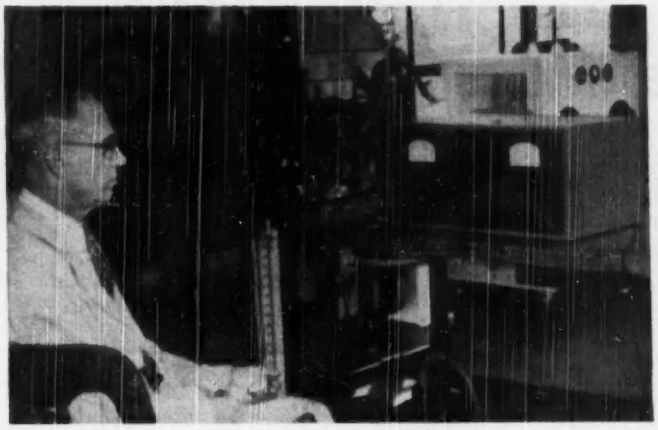
For the preparation of our profile, the contours were traced for approximately 100 ft on each side of the center line. Information as to any side slope is obtained from the contour detail on the plan section of the plan profile.

Accuracy Check . . . Where there were railroads or improved highways in the area, the horizontal scale was obtained by reference to their respective plans. However, there were some stretches where neither highways nor railroads existed; it was necessary to use the Coast and Geodetic Triangulation Point and Grid System for a horizontal check. As an indication of the accuracy obtained through aerial profiling, a check made between horizontal points approximately 49,000 ft apart showed a discrepancy of only 17 ft.

We also made several checks in the field on the accuracy of the profile. In one specific case we checked the profile over railroad switchbacks and found an error of only 0.4 ft, based on an accurate line of levels. However, the aerial survey company feels that such accuracy is beyond the normal expectation of photographic work of this scale. It does maintain that for 10-ft contours, 90% of all points on the line will be within 5 ft of true elevation, with a probable accuracy of 3-ft or less, and with maximum accuracy being obtained on higher elevations.

Locating Structures . . . Having received the plan and profile from the aerial survey, we had another new problem. Although the plan showed line stationing, we had no such stationing on the ground since we had done no chaining of the center line. This interesting problem also worked out as a good check on the accuracy of the profile. With a print of the profile roll, the staking crew located structures by measuring from a road, drain, edge of woods, fence or other recognizable feature which had a line plus on the plan. Where no such features were available we might note that a structure was 8 ft in elevation below the crest of a knoll and the next structure 5 ft below on the other side. We would then run levels down from the crest to each elevation and measure the span as a check. The spans never varied more than a few feet from the span plotted on the profile. In a very few cases we had to chain a few spans from a known point.

In Conclusion . . . Aerial profiling presented a few problems which we did not normally face. Nevertheless, it enabled us to send line plans to the construction department in less than six weeks after the photographic flight. It made possible the complete civil engineering of this line of approximately 62 miles, including the final staking of structures, in approximately seven months by one survey crew. It permitted actual construction three months after the line was authorized. In dollars and cents, although we do not yet have final figures, we believe we saved about 50% over normal civil engineering expenses. But most of all, we saved at least a year of surveying in very rugged country.



AUTHOR GEMANT takes a measurement involved in application of radioactive tracer technique to study of insulating oils. Tracer was radioactive carbon in an oil-soluble acid

Radioactive Tracers Explore Insulating Oils

New facts about insulating oils uncovered by radioactive tracer technique indicate that: (1) Organic acids added to an oil sample participate in sludge formation, (2) graphite powder adsorbs large fraction of harmful acid, and (3) compounds causing electrical conductivity of oil may be of molecular size

ANDREW GEMANT
Research Dept
Detroit Edison Co

A NEW METHOD introduced into the study of electrical insulating oils involves the application of radioactive tracers. This method is being used in the Research Dept of Detroit Edison Co. Three fields of application are outlined: (1) Sludge formation of oils, (2) adsorption as encountered in the reclaiming of used oil and (3) electrical conductivity of deteriorated oil.

In a radioactive tracer study a suitable compound of oil-soluble organic acid was first prepared containing a radioactive atom. The atom, introduced chemically into the acid, was a radioactive form of carbon, called carbon 14 because its atomic weight is 14. Next a suitable experiment was conducted that permits the labeled compound to move in the oil. Location of the acid in pure oil was detected by a Geiger-Muller counter; in other words, the rate of diffusion of the labeled acid in the oil was determined. From the movement of the labeled compound, information was obtained from which could be drawn pertinent conclusions applicable to practical problems.

One problem, the sludge forming ability of a labeled acid in oil was investigated. The labeled acid was added to the oil in a concentration corresponding to a so-called acid number of 0.3, and the diffusion rate determined. Then the oil was oxidized at 150 C, and from time to time the diffusion rate of the acid was checked. It was found that, as time progressed, the diffusion rate decreased. Now, the large polymer particles have a diffusion rate very slow compared with the original acid. Reduction of the observed rate of diffusion thus could be interpreted by the acid's gradual transformation into large polymers, which ultimately form sludge. A simple analysis then permitted computation of the percentage of acid that for given times of oxidation has been transformed into polymers. In this manner the participation of the acid in the sludge formation was shown, as well as the extent to which this reaction took place as time progressed (45% polymerized in 180 hr).

A second subject is adsorption. The substance to be adsorbed was the radioactive acid. The adsorbent in question was used in form of a finely divided powder and thoroughly mixed with the solution of the acid in oil. Part of the acid was then adsorbed by the finely divided powder. Whereas the original particle size of the acid was extremely small, it now became rather large, namely the size of the powder. This was sufficiently large to prevent diffusion. As a result, only that part of the acid diffused freely was not adsorbed.

Measurements were carried out on colloidally divided graphite as adsorbent. With an oil having an acid number of 0.3, about 40% of the acid was adsorbed.

The technique described will be suitable for analytical determinations in connection with adsorption.

As a third field of application, the high electrical conductivity of badly deteriorated oils is mentioned. By the author's previous researches certain combinations of acid with other organic compounds were found which produced high electric conductivities, similar to that observed in certain types of used oils.

Particle Size Estimated

The question then arises whether these compounds, in conjunction with the acid, form molecular or colloidal type of particles. The solutions in question were used for determining the diffusion rate of the labeled acid, and from the relation between diffusion rate and particle size the latter was estimated. The observed diameter was about double that of the acid alone, corresponding to a cluster of about 10 molecules, both sizes being in the small, molecular range. Hence, the tracer diffusion technique permitted the solution of a question that would have been difficult to find by other methods.

Does Mercury Street Lighting

Detailed comparison of fixed and operating costs on basis of equal performance in roadway illumination gives the edge to the incandescent lamp

WAYNE H. JOHNSON
and
HOWARD A. ENOS
American Gas & Electric Service Corp
New York

IT IS unquestionably true that light sources using vapors of metals such as sodium or mercury are more efficient in producing light than incandescent light sources. That is to say, the metallic vapor sources provide more lumens per watt. It does not necessarily follow that the high efficiency metallic vapor lamps provide better and more economical street lighting than do incandescent lamps. The attainable pattern of light distribution from luminaires is the most important factor in determining economical utilization of the available light.

Metallic vapor sources, being larger in surface area than the filament of an incandescent lamp, make it difficult to provide satisfactory control of light distribution. Because of such lack of proper light control much of the additional light produced is wasted by directing it into areas where it is not needed, or by providing highly non-uniform light distribution with high intensity over a relatively small area with low intensity outside of that area. As a result, the higher efficiency of the metallic vapor light sources is ineffectual and, as will be shown in the accompanying economic comparisons, is more than nullified from an economic standpoint.

Of the metallic vapor light sources available, sodium and mercury lamps have been promoted widely for street lighting. Sodium vapor lamps are now being promoted mostly for the doubtful advantage of the difference in color as a caution signal for hazardous locations. The mercury vapor lamp is, however, being strongly promoted for street lighting solely on the basis of the high efficiency of the light source.

It is misleading to compare, from an economic standpoint, street lighting systems using different types of light sources on the basis of average illumination on the entire pavement surface. The purpose of high intensity street lighting is to promote safety. Adequate illumination is only achieved when the average illumination on the pavement is equal to or above the recommended minimum, when the illumination in the traffic lanes does not fall much below the recommended average and is as uniform as practicable.

Non-Uniform Illustration

With highly non-uniform illumination a high average illumination may be obtained with a low minimum at some points combined with a high maximum at other points. That is the kind of illumination obtained with mercury vapor luminaires due to lack of proper control of the light. When a certain minimum illumination in the traffic lane is achieved with the mercury luminaire, the maximum illumination is so much greater as to waste lumens and give an unsatisfactory pattern of illumination on the pavement from the standpoint of safe visibility.

For the same average foot candles on a 100-ft pavement the ratio of maximum to minimum foot candles in the traffic lanes is 1.09 for the incandescent system and 1.66 for the mercury system. For a 50-ft pavement the ratio is 1.53 for the incandescent and 3.61 for the mercury system.

In order, therefore, to make economic comparisons on the basis of safety considerations, the comparison set forth in this article has been made on the basis of the same minimum foot candles in the traffic lane for both incandescent and mercury systems. The accompanying tables compare 20-amp series and 120- and

TABLE I—Incandescent vs Mercury Vapor Lighting for 100-ft Pavement Both with 1.62 min ft-c in Traffic Lane

	Incandescent		Mercury Vapor	
	20-Amp Series	120-V Multiple	20-Amp Series	240-V Multiple
ILLUMINATION AND DEMAND DATA				
1. Type lamp	PS-40	PS-40	EH-1	EH-1
2. Initial lumen output	15,000	15,300	21,000	21,000
3. Estimated yearly average lumen output	15,000	13,800	18,000	18,000
4. Rated lamp life hours	3,000	3,000	4,000	4,000
5. Average ft-candles on pavement	1.55	1.55	1.84	1.84
6. Type luminaire	IES-IV	IES-IV	Oval	Oval
7. Ratio max to min ft-c in traffic lane	1.09	1.09	1.4	1.4
8. Demand per mile (includes 10% kw losses)—kva	90	105.8	87	71.0
9. Power factor, %	100	100	75	92
CONSTRUCTION AND INSTALLED COST DATA				
10. Spacing, assumed (ft)	50	46	40	40
11. Standards per mile	106	115	132	132
12. Mounting height (ft)	30	30	30	30
13. Bracket length (ft)	6	6	6	6
14. Cost per mile (lighting system only)	$59,676	$63,365	$80,187	$77,952
15. Cost of back-up system				
(a) $217.50/kva for production to primary lines	$19,600	.....	$19,000	.....
(b) $252.00/kva for production to secondary lines	.....	$26,650	.....	$17,900
16. Total Installed Cost per Mile	$79,276	$90,015	$99,187	$95,852
ANNUAL COST				
17. 14% on total installed cost	$11,000	$12,620	$13,860	$13,400
18. 3% maintenance and operation of back-up system	$588	$800	$570	$537
19. Energy cost for 4,000 hrs @ $.006/kwhr	$2,160	$2,530	$1,562	$1,562
20. Maintenance (washing, replacement and other expense)	$813	$955	$2,380	$2,380
21. Total Annual Cost	$14,561	$16,905	$18,372	$17,879

Cost More Than Incandescent?

240-v multiple systems using mercury and incandescent light sources of the most modern type on the basis of total annual operating cost per mile of street for both 100-ft and 50-ft pavement widths. It will be noted that a 25-ft mounting height for the 10,000-lm incandescent lamps for lighting a 50-ft pavement has been adopted. This mounting height has been found practicable with IES type III luminaires, and IES is now considering recommending it.

TABLE II—Incandescent vs Mercury Vapor Lighting for 50-ft Pavement Both with 1.012 min ft-c in Traffic Lane

	Incandescent		Mercury Vapor	
	20-Amp Series	120-V Multiple	20-Amp Series	240-V Multiple
ILLUMINATION AND DEMAND DATA				
1. Type lamps	PS-40	PS-40	EH-1	EH-1
2. Initial lumen output	10,000	10,000	21,000	21,000
3. Estimated yearly average lumen output	10,000	9,740	18,000	18,000
4. Rated lamp life hours	3,000	3,000	4,000	4,000
5. Average ft-c on pavement	.94	.94	1.13	1.13
6. Type luminaire	IES-III	IES-III	Oval	Oval
7. Ratio max to min ft-c in traffic lane	1.53	1.53	3.41	3.41
8. Demand per mile (includes 10% kw loses)—kva	29.4	36.4	20.4	24.8
9. Power factor, %	100	100	75	92
CONSTRUCTION AND INSTALLED COST DATA				
10. Spacing, staggered (ft)	100	97.5	115	115
11. Standards per mile	53	55	46	46
12. Mounting height (ft)	25	25	30	30
13. Bracket length (ft)	6	6	6	6
14. Cost per mile (lighting system only)	$38,222	$37,589	$42,450	$43,153
15. Cost of back-up system				
(a) $217.50 kva for production to primary lines	$6,480	.....	$6,600	.....
(b) $252.00 kva for production to secondary lines	.....	$9,150	.....	$6,250
16. Total Installed Cost per Mile	$44,822	$46,739	$49,050	$49,403
ANNUAL COST				
17. 14% on total cost	$6,230	$6,550	$6,870	$6,930
18. 2% maintenance and operation of back-up system	$192	$274	$198	$188
19. Energy cost for 4,000 hrs @ $.006/kwhr	708	870	546	546
20. Maintenance (washing, replacement and other expense)	339	320	830	830
21. Total Annual Cost	$7,569	$8,014	$8,444	$8,494

Incandescent Costs Less

The tables disclose that the annual cost on this basis is considerably less for both series and multiple incandescent systems than for series or multiple mercury systems. It should be pointed out, however, that in the case of the mercury systems, the costs have been based on the use of poles with transformer bases to accommodate the ballasts required by mercury luminaires. Pole top ballasts, however, are available which, though not as ornamental as the transformer base poles, are entirely satisfactory and their use reduces the cost of the mercury systems for 100-ft pavement by $935 per mile per year. For a 50-ft pavement the cost is reduced by $325 per mile per year. Even with these reductions the incandescent system will still be seen to be more economical than the mercury system.

With the costs as shown, the comparisons clearly indicate that mercury vapor lighting neither should be sold at the same rate per lamp as incandescent lighting, nor should it be sold for less than incandescent lighting as has been the case in some cities.

These economic comparisons have been made using actual costs for material and average actual cost for labor. The systems were estimated for underground construction. Lamp replacement cost is based on rated life whatever may be the claimed experience of longer than rated life in actual use. It may be that mercury vapor lamps will be further increased in life, and if so, it may make a difference in the comparative economics of the two types of luminaires. The difference, if any, will depend on the average lumen output of the longer life lamp. The present incandescent lamps have a loss of lumen output at rated life of approximately 10% for series and 18% for multiple lamps, while EH-1 lamp loses about 29%.

Other Disadvantages

The kva demand for the mercury system is based on the normal operating demand of the group of luminaires considered, instead of the starting demand which is approximately three times the operating demand for air temperatures ranging from plus 35 F to minus 30 F. The starting demand of the mercury lighting system must be supplied from the distribution system from which it is served. Most systems could easily supply the required starting demand, but where the distribution system is inadequate to supply this demand at proper voltage, it might need to be rebuilt for necessary capacity.

This required starting capacity can be reduced by the use of a half-circuit relay on a series system. However, the installed cost of such relays is about equal to the savings in constant current transformer costs accomplished by their use. This permits no reduction in total annual cost.

Apart from any consideration of cost, the mercury vapor lamp suffers from other disabilities that should be given serious consideration. Momentary failure of supply or a 15% voltage dip will put the lamp out and about four minutes are required for the lamp to cool before it will restart and then another four minutes is required to reach full brilliancy. No matter how infrequent such an occurrence may be, the possibility of an eight-minute loss of full illumination militates against desirable safety considerations. Furthermore, the type of light supplied by mercury vapor lamps is not pleasing in many cases because of its effect on the appearance of persons, clothing and food products. The power factor of the series mercury system is very low, which is responsible for the high kva demand. The development of regulating transformers with improved power factor for the series mercury system has not yet reached the stage of practical application.

HOVERING about 6 ft above ground, helicopter waits while a line man attaches pulling cable to clevis on bottom of fuselage. Look closely to discern man at work under plane. Three weeks of trail building was avoided by using plane to string pulling-in cable

Transmission Line Construction Takes to the Air

Hawaiian Electric Co uses helicopter to lay stringing-in cable from air over difficult terrain. Avoids expense of cutting trails. Saves four weeks, cuts labor cost 60%

LAST MONTH engineers of the Hawaiian Electric Co not only proved that it is practicable to use a helicopter in stringing transmission lines, but they found that the resulting time and dollar savings are far beyond anything they had counted on. As a matter of fact, the Hiller 360 helicopter they used crossed ridges and gulches of the 44-kv right of way so fast on its cable laying mission that ground crews weren't prepared to keep up.

Highlights of the experiment were these:

1. About 25,000 ft of ⅛-in. steel "pulling-in" cable was laid by helicopter over extremely rugged and mountainous country in less than an hour of actual flying time—although the operation was spread over an afternoon and two mornings because of its experimental nature.

2. To lay this much cable by conventional methods would have required an estimated three weeks to cut trails and another week or more to drag in the cable.

3. Besides this time saving, labor costs were pared to the point where a saving in excess of 60% was possible, even after including the cost of helicopter rental.

The Job . . . facing Hawaiian Electric was construction of a new 44-kv line from its new Waiau power plant, by Pearl Harbor, to the Koolau switching station in the hills above Honolulu. This involved cutting a stringing trail from tower to tower across the gulches, and building approach roads and trails up the ridges to the tower locations.

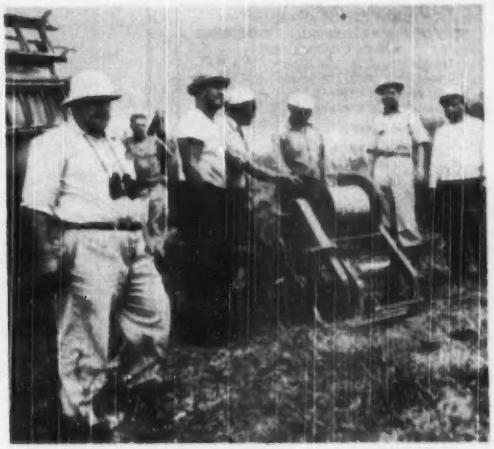
The Idea . . . occurred to James P. Michels, Hawaiian Electric's superintendent of distribution, that a helicopter might be used for laying out stringing cable and so avoid the cost of trail building. As a quick check on the idea, 900 ft of cable was successfully laid out by helicopter along a convenient canefield road.

That settled it. The helicopter was brought to the job and on the first afternoon—March 2—laid 2,000 ft of regular ¼-in. steel pulling-in cable on its first trial.

The 'copter picked up the end of the cable from a reel on the ground. With it the pilot was instructed to fly along the top of the 60-ft towers letting the cable fall along the base of the towers. The pull was successful and took only 3 min. Near the end, however, drag from the weight of the cable was quite noticeable.

For the main job the company obtained 23,000 ft of ⅛-in. 7 x 19 strand carbon steel cable weighing 29 lb per 1,000 ft, having a breaking strength of 2,000 ft. This cable was distributed among five reels; one

TOWING pulling-in cable, the helicopter takes off. A surplus bomb release allows pilot to drop the cable at any time he wishes



POWER REEL STAND using 1/8-in. cable and driven by 4-hp engine pulls back 1/4-in. bull line from winch at remote tower

with 8,000 ft, two with 4,000 ft and two with 3,000 ft.

On the job these reels were taken by truck up accessible ridges along the right-of-way to the tower locations and set up in a power reel stand equipped with a 4-cycle, 4-hp gasoline engine. Then, after the 'copter had flown the ⅛-in. cable out, the power reel was used to wind it back bringing with it a ¼-in. "bull" line from the remotely-located winch that was used to pull the line conductors.

The Helicopter Job . . . was to pick up the end of each ⅛-in. cable and fly it over to the tower on the next ridge, making two turns around the tower before dropping the cable. A lineman on the ground then secured the ⅛-in. cable to the ¼-in. winch line.

No effort is made to keep the stringing cable taut and off the ground when flying it out. It was allowed to run freely from the reels with only enough braking used to prevent the reels from "running away." Longest piece of ⅛-in. cable laid was 8,000 ft. It took 8 min.

One Big Problem . . . in using the helicopter was to devise a means for the 'copter pilot to release the line quickly whenever necessary.

This was solved by installing a bomb release from a surplus military plane. The release was operated from the cockpit.

A towing clevis, including the release, was attached to the bottom of the fuselage, almost directly beneath the pilot's seat. A short piece of $\frac{3}{16}$-in. cable was constructed with a special eye to fit the bomb release and another eye to which the lineman could attach the stringing-in cable.

The lineman simply pulled the end of the stringing-in cable through this eye and secured it with "U" bolts. It was easily released by another lineman at the end of the run. The helicopter had no trouble hovering in place for this operation.

"During the entire job," Michels said, "the helicopter proved to have remarkable stability. Wind gusts had no apparent effect on the machine and even moderate winds up to 30 mph did not seem to interfere with its operation.

Flying Load . . . "We estimated its greatest flying load during the demonstration was between 450 and 500 lb. Flying speed on the longest haul was about 10 mph.

"Accuracy was assured as the pilot could hover at will and drop the cable exactly as directed.

"The saving effected by this operation was considerable—both in time and money. Flying the stringing-in cable along the right of way saved the cost of clearing out a stringing trail."

Michels estimates that 220 man-hours of work might have gone into clearing the trail and dragging in the cable along the ground.

Although more men were used because of the experimental nature of the work, he estimates that a supervisor, a foreman and six men could have completed the work easily in two days with the aid of the helicopter. Principle chore for the men would be to handle and spot reels.

Radio Needed . . . The operation might have profited, it was suggested later, had there been radio communication between the pilot and a centrally located superintendent.

Hawaiian Electric actually paid for 10 hr of flying time for the helicopter—4 hr flying the plane 136 miles from its base and back, 2 hr in survey work, 4 hr in laying the line and demonstrating flying technique to various personnel.

The price for the experimental work was not disclosed but it is believed that the machine could be rented in the future for about $50 an hr, including the pilot's services.

Any disadvantages to the technique?

"There were really none," comments Michels, "we found everything very satisfactory."

He thinks the technique will prove most valuable in areas where trail cutting would otherwise be required.

Special permits for the test were obtained from both the CAA and the Hawaii Aeronautics Commission.

As a safety measure, lines paralleling the operation were de-energized.

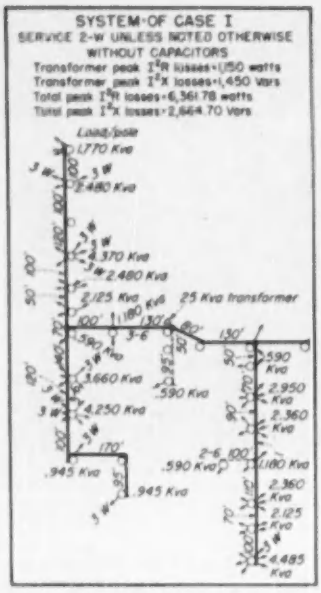


FIG 1—**CASE I BEFORE** capacitors were installed, with 44 2-w and 17 3-w services

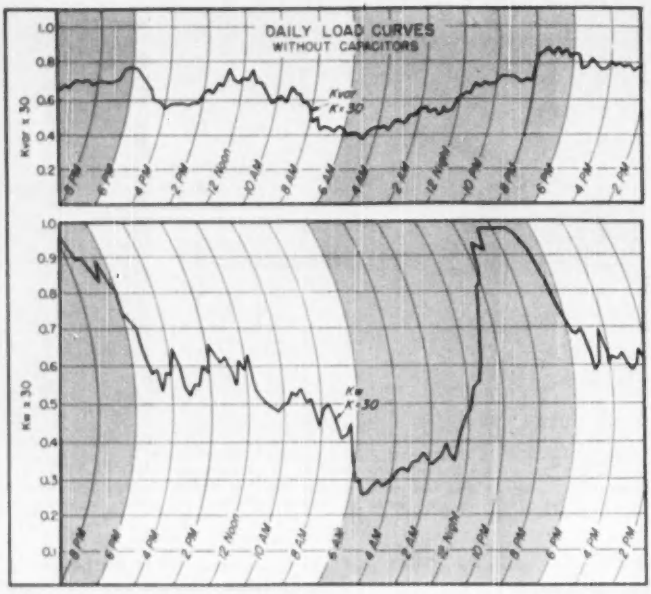


FIG 2—**DAILY KW AND KVAR LOADS** on 25-kva transformer and secondary system of CASE I before adding 9 kvar of secondary capacitors. Peak load was 42.5 kva at 77.5%

Secondary Capacitors Pay Their Way In Urban Little Rock

One of the first companies to install secondary capacitors shows that they paid their way by reducing losses and releasing transformer and secondary capacity

H. E. STRATTON
Electrical Engineer
Ebasco Services, Inc
Little Rock, Ark.
and
R. A. WILLIAMS
Assistant Distribution Supt
Little Rock Div
Arkansas Power & Light Co

MANY UTILITY operating engineers today doubt the practicability of pole-mounted secondary capacitors for kvar generation.

They remain skeptical, in spite of recent theoretical presentations demonstrating the economies and benefits possible with secondary capacitors, possibly because there has been a lack of operating experience with secondary capacitors on utility distribution systems. Consequently questions have arisen as to the benefits of secondary, as compared to primary, capacitors.

Theory has shown, however, that as far as primary distribution, transmission, and generating systems are concerned, these things are true:

1. One kvar of secondary capacitors is equivalent to slightly over one kvar of primary capacitors.

2. A secondary capacitor reduces current in the secondary conductor and distribution transformer thus reducing kw losses, releasing transformer capacity and load carrying ability of secondary conductors.

3. The installed cost per kvar of secondary capacitors—although higher than primary capacitors—can be justified economically in installations where primary capacitors are economic, IF the capitalized benefits to transformer and secondary outweigh the higher cost of secondary over primary capacitors.

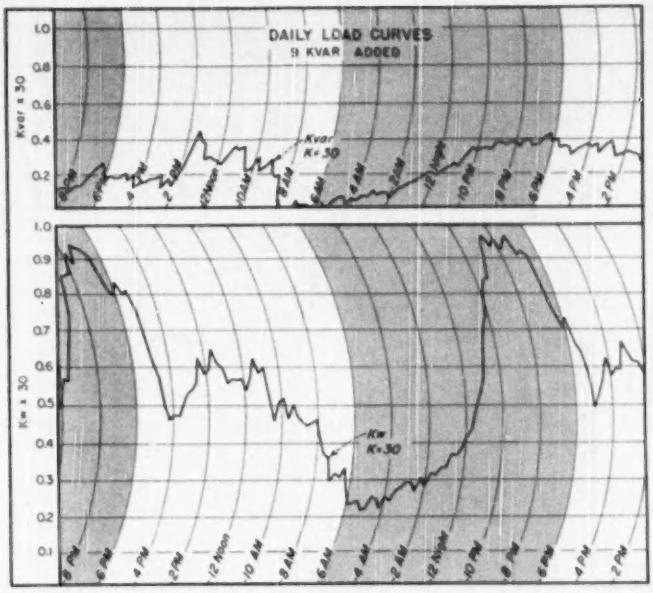


FIG 3—WITH CAPACITORS INSTALLED, daily kw and kvar loads on system of CASE I are shown above. Peak load was reduced from 42.5 kva to 37.5 kva by 9 kva of capacitors

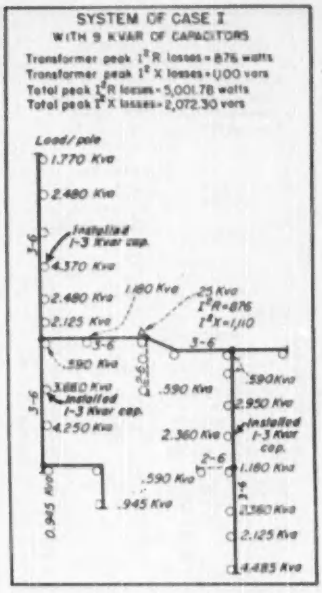


FIG 4—CASE I AFTER installation of secondary capacitors. Note drop in peak losses

Two Trial Installations . . . Recently, however, Arkansas Power & Light Co has installed a limited number of 3-kvar, 240-v capacitors on secondaries associated with two 25-kva transformers in average older residential sections of the City of Little Rock.

Tests were run on these trial installations during the summer of 1949, and results were analyzed to indicate quite clearly that:-

1. Secondary capacitors will effect considerable savings in loss costs.

2. Postponement of additional investment is possible when secondary capacitors are installed in moderate amounts on residential secondaries having load characteristics similar to those throughout urban areas of Arkansas Power & Light.

3. Where primary capacitors are indicated it would be well to re-examine the situation since, in many cases, secondary capacitors in amounts up to 35% of the peak kvar load will prove attractive.

In order to secure a record of transformer loading conditions, a portable metering cabinet was designed and built that contained two 240-v strip-chart demand meters, one used to measure kw and the other, in con-

TABLE I—Economic Analysis for Transformer Secondary System of Case I

Reduction in Losses and Capacity Released in Transformers and Secondaries

Demand Component of I²R, reduction	1.36 kw
Demand Component of I²X, reduction	.592 kvar
Transformer capacity released	5.0 kva
Energy Loss, reduction	2,980 kwhr

Assumptions Used in Evaluating Savings

Value of kilowatt of demand on system peak	$270.00*
Value of each kwhr	.003
Annual fixed charges for capitalizing losses	13%*
Value of kilovar for evaluating I²X	$7.00
Installed value of 7.62-kv distribution transformer per kva	$13.00
Load factor calculated	42%
Loss factor calculated	25%
Installed cost of primary capacitors per kvar (Actual)	$7.00
Installed cost of secondary capacitors per kvar (Actual)	$11.00

Annual Savings from Reduced Losses and Capacity Released

Demand Component of I²R	= 1.360 × $270.00 × .13	= $47.73 per yr
Demand Component of I²X	= .592 × $ 7.00 × .13	= .54 per yr
Energy Loss	= 2,980 kwhr × .003	= $ 8.94 per yr
Transformer Capacity Released	= 5 × $13.00 × .13	= $ 8.45 per yr
Total Annual Savings in Transformer Secondary System		$65.66 per yr

Note: The use of 13% fixed charges and $270 for system investment may be somewhat higher than is the case for some other situations.

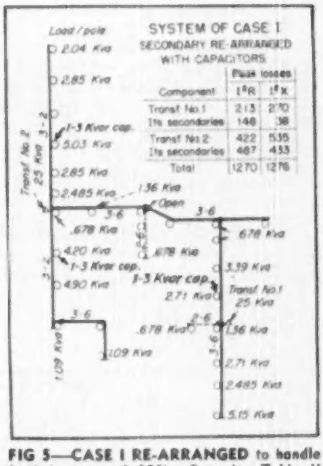


FIG 5—CASE I RE-ARRANGED to handle load increase of 15%. See also Table II

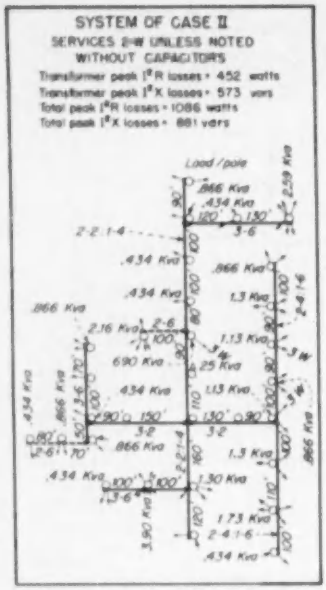

SYSTEM OF CASE II
SERVICES 2-W UNLESS NOTED
WITHOUT CAPACITORS
Transformer peak I²R losses = 452 watts
Transformer peak I²X losses = 573 vars
Total peak I²R losses = 1086 watts
Total peak I²X losses = 881 vars
Load / pole

FIG 6—**CASE II BEFORE** installing 12 kvar of capacitors; 57 2-w and 3 3-w services

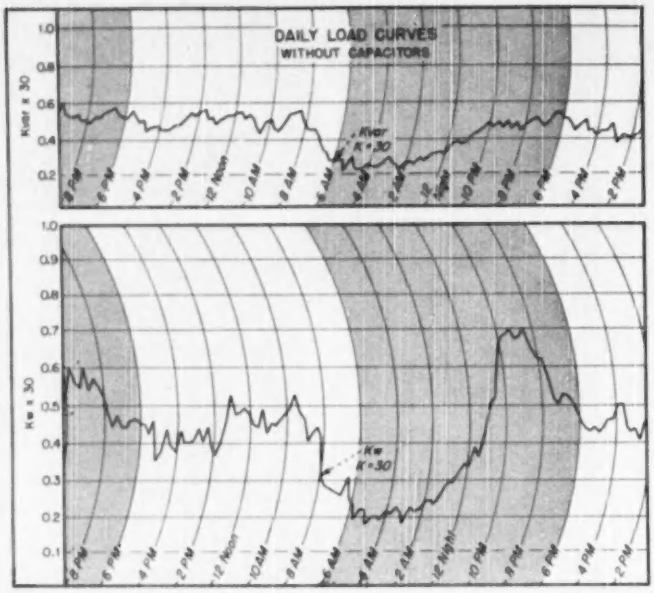


FIG 7—**DAILY KW AND KVAR LOADS** on 25-kva transformer and secondary system of CASE II before installing secondary capacitors. Peak load was 26.7 kva at 78.5% power factor

junction with a phase-shifting network (Rectiformer), to measure kvar. This cabinet was mounted on the transformer poles and a multi-conductor cable run to 150-5 amp current transformers connected in the distribution transformer leads. This metering device was installed on a transformer several days before capacitors were installed on the secondary and removed several days after capacitor installations were completed.

TABLE II—Economic Analysis for Transformer Secondary System of Case I As Re-arranged
(See Fig 5)

Reduction in Losses and Capacity Released in the Two Transformer Secondary System

	Trans No. 1	Trans No. 2		Total
Demand Component of I²R	.069 kw	.206 kw	=	.275 kw
Demand Component of I²X	.053 kvar	.199 kvar	=	.252 kvar
Energy Loss	151 kwhr	452 kwhr	=	603 kwhr
Transformer Capacity Released	1.4 kva	3.4 kva	=	4.8 kva

Annual Savings From Reduced Losses and Capacity Released
(See Assumptions in Table I)

Demand Component of I²R	=	.275 × $270.00 × .13	=	$9.65 per yr
Demand Component of I²X	=	.252 × $ 7.00 × .13	=	0.23 per yr
Energy Loss	=	.603 × .003	=	1.81 per yr
Transformer Capacity Released	=	4.8 × $13.00 × .13	=	8.11 per yr
Total Annual Savings in Transformer-Secondary System			=	$19.80

TABLE III—Economic Analysis for Transformer Secondary System of Case II

Reduction in Losses and Capacity Released in Transformer and Secondaries

Demand Component of I²R, reduction	.332	kw
Demand Component of I²X, reduction	.314	kvar
Energy Loss, reduction	727	kwhr
Transformer Capacity Released	5.7	kva

Annual Savings from Reduced Losses and Capacity Released
(See Assumptions in Table I)

Demand Component of I²R	=	.332 × $270.00 × .13	=	$11.65 per yr
Demand Component of I²X	=	.314 × $ 7.00 × .13	=	.29 per yr
Energy Loss	=	727 × .003	=	2.18 per yr
Transformer Capacity Released	=	5.7 × $ 13.00 × .13	=	9.63 per yr
Total Annual Savings in Transformer-Secondary System			=	$23.75 per yr

Case I . . . The transformer and secondary arrangement of the first installation is shown in Fig 1. There were 44 2-w services and 17 3-w services connected to this transformer as shown. Peak load was 42.5 kva at 77.5% power factor. Assuming 750 va for a 2-w and 1,200 v amp for a 3-w customer and applying proper diversity factors to make load total 42.5 kva, loads were divided up and assigned to poles. Loads per pole as well as I²R and I²X losses were calculated for the secondaries and transformer and are summarized on Fig. 1. Figure 2 shows daily kw and kvar loads on the transformer before capacitors were installed.

Subsequently 9 kvar of secondary capacitors were installed as shown in Fig 4 to secure unity power factor at light load. As a result, peak kva on the transformer was reduced to 37.5 kva. Daily kw and kvar loads after capacitors were added, were as shown in Fig. 3. Peak I²R and I²X losses for the secondary and transformer were re-calculated and are as

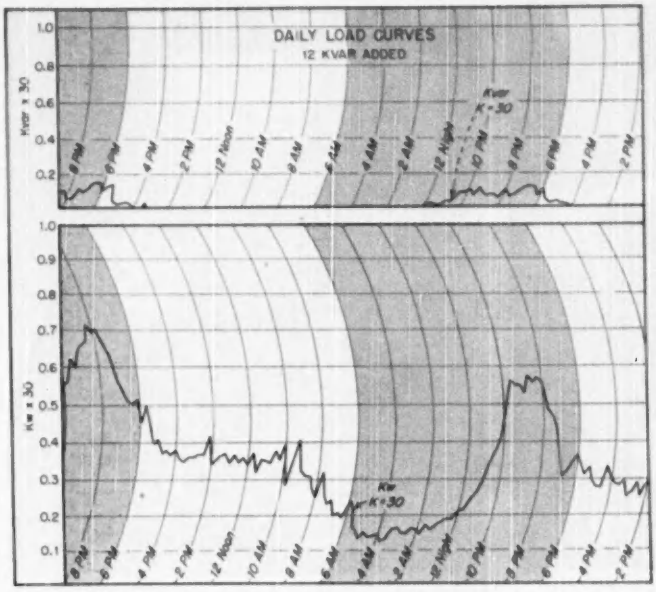


FIG 8—WITH CAPACITORS ADDED, daily kw and kvar loads on the transformer and secondary system of CASE II are as shown above. Peak load dropped from 26.7 kva to 21.9 kva

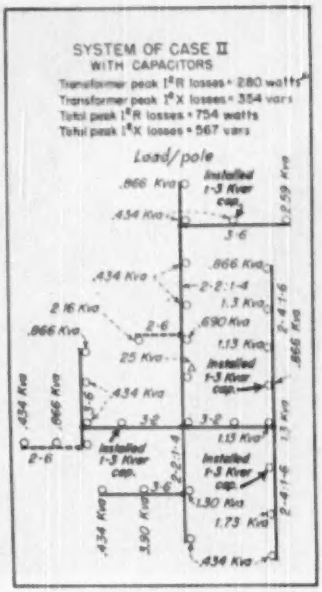

SYSTEM OF CASE II
WITH CAPACITORS
Transformer peak I²R losses = 280 watts
Transformer peak I²X losses = 354 vars
Tshi peak I²R losses = 754 watts
Tshi peak I²X losses = 567 vars
Load/pole
Installed 1-3 Kvar cap.

FIG 9—CASE II AFTER installing 12 kvar of capacitors. Note drop in peak losses

shown in Fig 4.

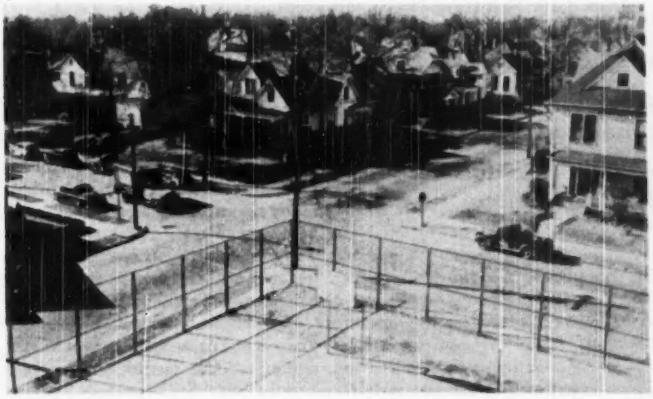
Reduction in losses and capacity release in the transformer and secondary system are summarized in Table I.

It is evident that the transformer secondary system of Case I is about at the point where re-arrangement would ordinarily be needed. Voltage drops are excessive in the long No. 6 copper secondaries. Load is approaching the safe operating limit of the transformer, but the voltage rise caused by the installation of capacitors makes it possible to defer rearrangement of transformer secondary system for a short time.

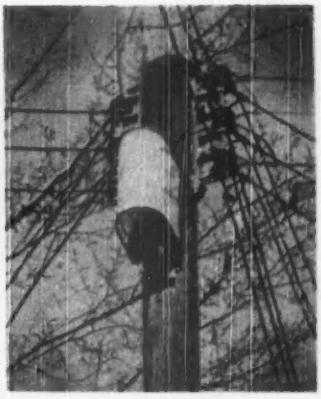
Case I Rearranged . . . We shall now assume that some time later, loads have increased 15% and re-arrangement has been made as shown in Fig 5. Observe that the location and amount of secondary capacitors has not been changed. For this condition the reduction in losses and capacity release occurring in the two transformer secondary systems may be summarized as in Table II.

Comparing the cost and total annual savings in transformer secondary system, both before and after secondary re-arrangement, shows that the use of secondary capacitors will be economically justified without con-

(*Continued on page 157*)

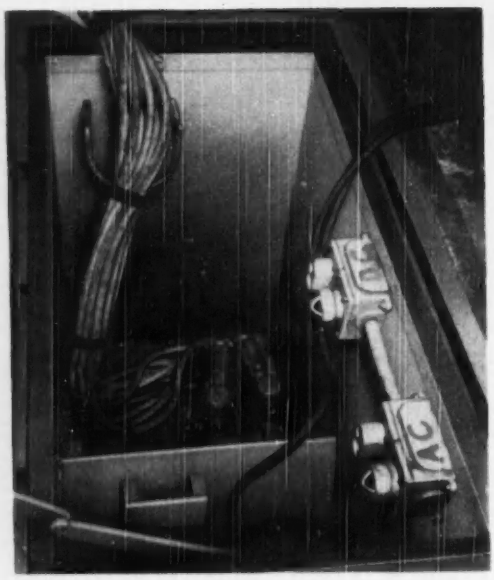


RESIDENTIAL AREA of Little Rock typical of that involved in CASE 1. Tests conducted in summer of 1949 showed considerable saving in loss costs was effected with 3-kvar capacitors



SECONDARY CAPACITOR hung at secondary level, connected to 240-v secondaries

GROUND POWER RECEPTACLE of Boeing 377 is directly over power pit in normal parking position. Control relay on third wire keeps pit plug "dead" until it is inserted into plane's receptacle. Hinged pit covers are stressed for the plane's wheel loadings



POWER PIT with 1,500-amp capacity for Boeing 377 Stratocruisers and DC-4's showing the two "Mole" type insulated cable connectors. Ac indicating type push button station at right actuates 75-hp motor of m-g set. The dc pushbutton actuates a motorized dc breaker

Airport Power Pits vs Mobile Units

Here's why Northwest Airlines installed built-in airport apron power pits at most of their stations—replacing their mobile power units—

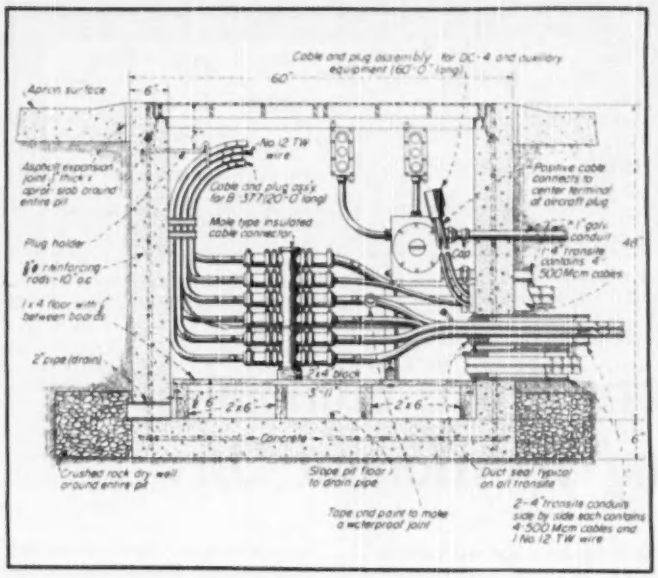
- **Power is ample for largest planes**
- **Initial installation is cheaper**
- **Maintenance and operation costs are lower**
- **Servicing time is quicker regardless of weather conditions**
- **Portable equipment on apron is reduced in number—apron is less cluttered-up**

E. S. HAMM
Apron Equipment Engineer
Northwest Airlines, Inc
and
MORRIS BRENNER
Asst Technical Service Engineer
Burndy Engineering Co, Inc

GROUND POWER PITS built into airport aprons have been gradually replacing mobile power supply units as a dc source for parked airplanes on the Northwest Airlines system. This transition is being made at all NWA airports and has resulted in speedier servicing of planes, and lowered maintenance costs compared to the previous method of supplying ground power.

The 27½-v dc power is required to maintain essential loads to an airplane while it is parked on an airport terminal apron. These loads consist of lights, heaters, blowers, radio equipment, galley food containers, and starting engines. Present practice in many airports is to supply this power by means of mobile battery carts, generators, or rectifiers. These units clutter up an already overcrowded apron, and where batteries are used, regular recharging is necessary. On the NWA system this was particularly troublesome due to severe weather conditions encountered over several months of the year.

The 1,500-amp capacity pits described in this article are now in operation at the Detroit, Milwaukee, Minneapolis, Spokane and Seattle Terminal airports. Another is being completed at Portland, Oregon.


Cable and plug assembly for DC-4 and auxiliary equipment (60'-0" long)
60'
6"
Apron surface
No. 12 TW wire
Asphalt expansion joint ½" thick x apron slab around entire pit
Cable and plug ass'y for B-377 (20'-0" long)
Mole type insulated cable connector
Positive cable connects to center terminal of aircraft plug
2" galv. conduit
4" transite contains 4-500 Mcm cables
Plug holder
Reinforcing rods 10" o.c.
1 x 4 floor with ½" between boards
2" pipe (drain)
2 x 4 block
3'-11"
2'-6"
2'-6"
6"
Concrete
Crushed rock dry well around entire pit
Slope pit floor ½" to drain pipe
Duct seal typical on all transite
Tape and paint to make a waterproof joint
2-4" transite conduits side by side each contains 4-500 Mcm cables and 1 No. 12 TW wire

SECTION THROUGH PIT for B-377 and DC-4 showing "Mole" connector in left section with six 4/0 cables per leg leading to the B-377 plug. Two 2/0 cables in right section of pit lead to DC-4 plug. Note pit drain and dry well, lower left, and watertight insulating sleeves

. . . Which are Better?

The mobile power units are used only at those airports where moves to new locations are contemplated in the near future, or at locations in the Orient where a dependable source of power is not available or the cost of providing ac power is prohibitive.

For regular terminal operation, the mobile units are currently being used at New York International Airport and at Chicago. These units will also be used at Tokyo and Manila when Boeing 377 operation is started to these stations. Mobile units are also kept at Seattle, Minneapolis and St. Paul to supply aircraft with electrical power for run-up purposes, and at locations remote to the apron proper where it is not feasible to provide pit installations. The units at Minneapolis and St. Paul also take care of emergency conditions when more airplanes are on the terminal apron and at gate positions than can be serviced from the pits.

The average cost of the NWA 1,500-amp pit installations is $11,235 compared to $18,000 for a mobile truck-mounted unit of equal capacity. The annual saving in operating cost to this power pit installation over the mobile truck averages $3,165.

For the 500-amp installations, the average cost of the power pit jobs was $3,647 compared with $3,800 for a similar capacity truck-mounted unit. The saving per year of these pit installations over the truck-mounted units averaged $675.

Electrical System

A number of these ground power pits are installed on the airport apron so that the ground power receptacle of the airplane is directly over the appropriate pit when the plane is parked. Power at 27½ v dc is supplied to the pits from a 50-kw m-g set, usually housed in the basement of the Administration Building, through four 500-Mcm cables per leg.

The 500-Mcm cables are terminated in the pit in two "Mole" type insulated cable connectors. Six 4/0 aluminum cables per leg are taken from the connectors to provide the 1,500-amp dc supply to the Boeing 377. Power to the Douglas DC-4 is supplied by taking one 2/0 aluminum cable per leg from the connector. Power to the Martin 202 is supplied through a separate pit which is in parallel with the Boeing pit.

Special sleeves were used on the connectors to eliminate the need for taping, and also for ease of replacement of the cable and plug assemblies. Aluminum cable was selected so as to permit easy handling when connecting or disconnecting from the airplane. The cable was indented to tinned copper plugs filled with Penetrox "A." The plugs in turn were terminated to the connector by standard socket and nut clamping elements.

The motor-generator sets are equipped with overload, over-voltage, and reverse current protection. Line loss in the 500-Mcm legs is automatically compensated for by a compensator resistor in parallel with one set of generator series fields. A third wire control relay keeps the B-377 pit plug "dead" until it is inserted into the airplane receptacle. When the plug and receptacle have been properly mated, the relay closes, which in turn permits the main circuit breaker to close.

Pit Construction

Initial pit installations were for the Martin 202 and Douglas DC-4 aircraft and had output capacities of only 500 amp. When the Boeing 377 was added to the Northwest fleet it was necessary to increase the pit capacity to 1,500 amp. This was done by building new pits which could handle the load of both the Boeing 377 and Douglas DC-4. The Martin 202 was serviced from a separate lower capacity pit.

The Boeing 377–Douglas DC-4 pit is 2 x 4 x 4 ft deep, with 6 in. thick reinforced concrete walls. The Martin 202 pit is 1½ x 2 x 2½ ft deep with 6 in. thick reinforced concrete walls. Though all the connections are watertight, all equipment is mounted off the floor on a wooden platform, and the pit it pitched to drain into a crushed rock dry well.

Experience has proven the pit method of supplying dc ground power to be economical and far more convenient than using mobile units.

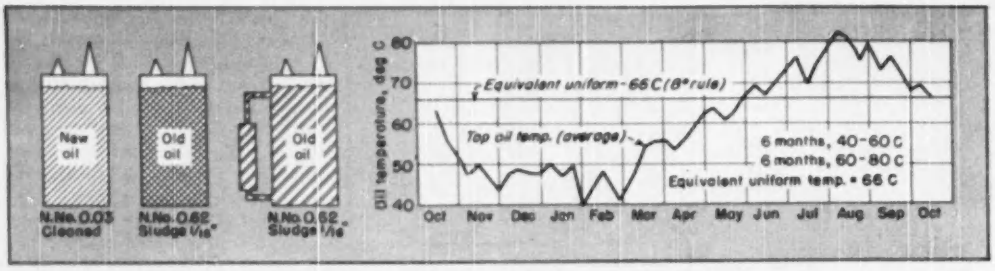


FIG 1—THREE TRANSFORMERS were selected for test. One (at left) was filled with new oil, one (center) with old oil, and one (right) was filled with old oil and equipped with thermo-siphon filter. Load cycle gave oil temperatures shown in curve as a 4-year average

Thermo-Siphons Prove Economical For Cleaning Transformer Oil

Test covering four year period shows that oil can be purified on a continuous basis. Three transformers are compared under similar load conditions

L. M. LIMPUS
Oklahoma Gas & Electric Co
Oklahoma City

FOUR YEARS of experimental observation, on the Oklahoma Gas & Electric system, indicates that the economics of thermo-siphon oil filters in continuous operation for cleansing oil revolve around size and age of transformers, and whether the oil has reached or is approaching the condition where it must be replaced or cleansed. Experiments indicate that for large transformers, the application of such filters is practical, efficient, and economical.

Economics

Studies were made on three single-phase, 500-kva, 36.4/2.4-kv, open-type, free-breathing transformers that were 15 yr old when the studies were started. Each transformer required 672 gal of oil, or 2,016 gal for the three. Under such circumstances the choice lies between replacement of old oil with new, or cleansing of the old oil if it can be cleansed satisfactorily. Experiments indicated that cleansing could be accomplished satisfactorily, leaving only the question of relative cost to be considered.

From paper presented at the Doble Client Conference, Boston, Mass.

It was assumed that the transformers would last another 30 yr. Replacement of the 2,016 gal of oil at 30¢ per gal would cost $604.80. Based on replacement of oil every 15 yr, oil cost would be 2¢/gal/yr. Labor and transportation would bring this up to 3.74¢/gal/yr. Cost of thermo-siphon equipment is $480 and labor and maintenance brings the cost to 2.98¢/gal/yr, or an annual saving of only 0.76¢/gal/yr in favor of using thermo-siphons to cleanse transformer oil.

The analysis indicates that this quantity of oil (672 gal per transformer) is about the minimum quantity that can be economically protected with thermo-siphons in such applications. As the quantity of oil increases, the cost of thermo-siphons and maintenance per gallon is reduced. Application of thermo-siphons is quite attractive, economically, for 1,500 gal and up.

Conditions were set up so that a comparison could be made to determine the effectiveness of thermo-siphon cleansing. Results show that the filters will even cleanse certain areas of the interior, but removal of precipitated sludge from quiescent areas is not effected.

Figure 1 shows the three single-phase, 500 kva, 36.4/2.4-kv open-type, free-breathing transformers tested. Individual loads were approximately balanced, and the transformers were operated during the four-year test period to give the typical average top-oil temperature curve shown in Fig 1. Under the "eight-degree rule," this curve is equivalent to a continuous 66 C value throughout the entire period.

To start the test in October, 1944, one transformer was completely rehabilitated, cleaned inside and out, and filled with new "WEMCO-C" oil. The second transformer was left as found, with $\frac{1}{16}$ in. of sludge on the horizontal surface and a neutralization number of 0.62 mg KOH for its oil. The third transformer was left as found, except for the installation of a thermo-siphon filter (and dehydrating breather). Sludge depth in this unit was also $\frac{1}{16}$ in. on the horizontal surfaces, and its oil neutralization number was 0.58 mg KOH—only 0.04 less than that of the second and third transformers.

Prove Oil Cleansing Ability

Acidity trends during the first 3½ yr of the test period are shown in Fig 2. The curve for the old oil, with-

out filter, shows a sine-wave form following the hot and cold seasons of the year (increases in acidity during the cooler periods and decreases during the hotter periods).

Middle curve, for oil with filter, shows the usual tapering rate of improvement trends—a pronounced slowing of the rate as the lower values are approached. This curve is diagrammed to show changes in filtering material. Test was started using small cylindrical blocks of porously moulded bauxite. This material was used for 1¼ yr. It was then replaced with similarly moulded blocks of activated alumina. Principal reasons for replacement with another material were: (1) The activity of the blocks was evidently spent; (2) although they could easily be reactivated, they were fragile; and (3) the quality and blending of raw bauxite was not consistent.

The new charge of activated-alumina blocks was continued in service for one year and ten months. They were then replaced with the same material. These blocks are still in service and will doubtless be subject to reactivation (by thorough steam cleaning and drying) in about one to two years. The oil neutralization number has been reduced from 0.58 to 0.14 in 3¾ yr at an equivalent constant temperature of 66 C.

Contrary to some contentions, the steam-emulsion value has not shown a marked increase. As shown at the end of the curves in Fig 2, the three steam-emulsion numbers are approximately equal.

Power-factor values have followed these curves quite closely in value and in shape.

Figure 3 shows interfacial-tension trends. A tensiometer was not obtained until the latter part of 1945 and some samples had aged in the laboratory almost a year before the IFT values were determined. This probably accounts for some of the values found in early tests.

The bottom curve for the old oil, without filter, shows an anomalous increase during the first six months. The anticipated continuing drop in interfacial tension, although expected to be quite slow, is not in evidence. This is not altogether surprising, since IFT's in this range could be expected to show a fictitious saturation of polar contaminants that might remain constant for such period of time as is required to force the fictitious value lower by actual increase in contaminant concentration below the temporarily constant value. Values do appear much lower than the 14 to 15 range shown. One sample was as low as 4.

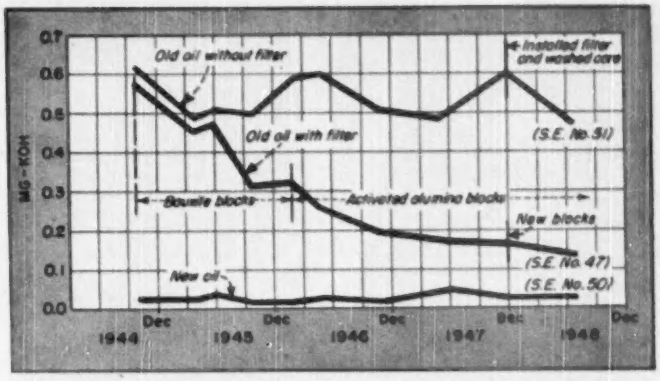


FIG 2—ACIDITY OF OIL in transformer with filter dropped as the test progressed, center curve. Bauxite filter blocks were changed to activated alumina blocks early in 1946

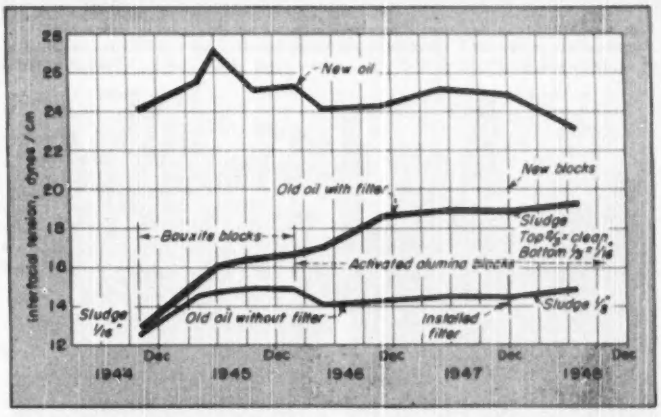


FIG 3—INTERFACIAL TENSION of oil being filtered increased rapidly, as expected, under the influence of activated alumina blocks and there was a pronounced slowing down of rate of increase as higher values were approached. IFT has increased from 13 to 19.4 in 3¾ years

The curve for the oil being treated increased rapidly as expected under the influence of new blocks, while the IFT values are low and showed a pronounced slowing down of the rate of increase as the higher values were approached. It is expected that 1 to 3 more years of continuous filtering will be required to attain the desirable value of 22 or higher. The IFT increased from 13 to 19.4 in 3¾ yr.

Sludge depth at the start of the test was 1/8 in. for each transformer containing oil. At the end of 3 yr and 2 months it had increased to ¼ in. in the unit that was left as found. In the unit equipped with the filter there was actual sludge removal.

Core Cleansing Ability

Photographs of the cores from the two transformers containing the old oil, Fig 4, show relative sludge conditions. On the core at the right, from the transformer without filter, sludge deposited upon the vertical surfaces is readily seen. The identification tag attached to a coil lead has been wiped clean across its middle to show the existence of an appreciable amount of sludge.

On the left is the core from the

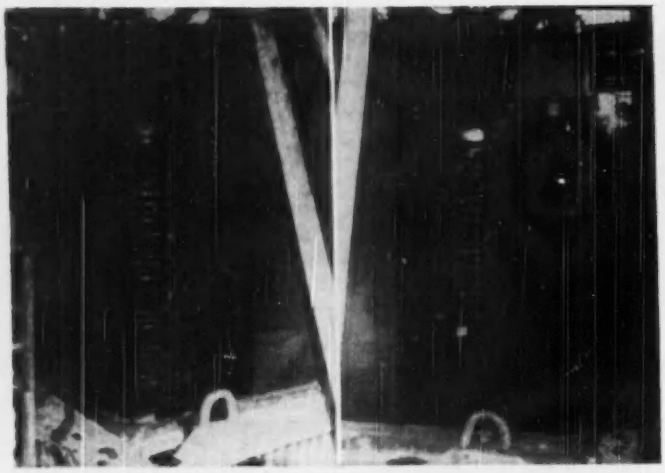


FIG 4—CORES from two transformers containing old oil show relative sludge conditions. Top two-thirds of core from transformer with filter, left, is clean while bottom one-third is in condition preceding test. Core at right, without filter, shows sludge on vertical surfaces

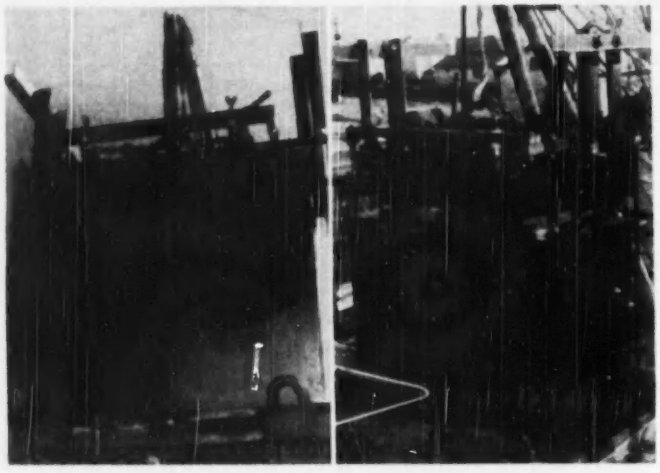


FIG 5—CURVED SLUDGE LINE is pronounced on high voltage barrier of transformer equipped with filter, left. Right, opposite side of same core with barrier laid back shows sludging behind cleaned area on barrier exterior. Core top and end barrier are clean

transformer equipped with the filter. The top 2/3 of this core assembly is clean, while the bottom 1/3 is sludged. The amount of sludge on the bottom is equal to the amount found when the test was started. The pronounced curved sludge line near the bottom of the Fuller board barrier in the lower right-hand corner of the picture is important and needs further discussion.

Figure 5 shows opposite sides of the core of the transformer equipped with filter. Here the curved sludge line is quite pronounced on the high-voltage barrier in the photograph on the left. The photograph on the right shows this barrier loosened and laid back to reveal the coil stack behind it. The stack is sludged in the area immediately behind the cleaned area on the outside of the barrier. The core top and end barrier are clean.

Since there was no sludge deposited within the filter and the oil was sparklingly clean, it was concluded that the cleansed oil dissolved the $\frac{1}{16}$ in. sludge deposits in the areas subjected to the agitation, or wiping action, of the oil currents. No sludge was removed from the quiescent areas. Results of this test indicate that thermo-siphon filtration, with activated alumina, will suitably cleanse the oil of objectionable contaminants. It will dissolve soft sludges in agitated areas and remove the sludge as a solute from the oil. It will arrest further sludging, but it will not remove sludge deposited in recesses and quiescent areas.

Flexible Numbering Plan For Customer Accounts

JOHN L. WALKER
Supervisor Meter Reading Dept
The Dayton Power and Light Co
Dayton

CONTINUOUS numbering of customer accounts is rapidly becoming known for its many advantages over previous systems and has been adopted by The Dayton Power and Light Co. Briefly the plan is as follows: All accounts are arranged in meter reading order, numbered in a continuous sequence and then divided into equal daily meter reading assignments. Total daily assignments are then divided so as to provide a uniform monthly meter reading schedule.

Advantages of this plan are:

1. It eliminates periodical costly rerouting, since meter sheets can be shifted from book to book with no change in the account number.

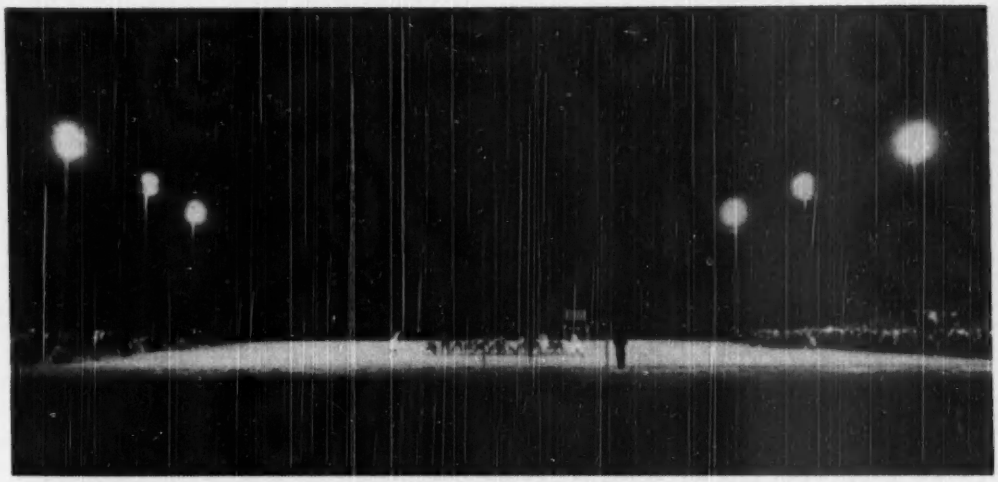
2. New meter reading personnel can reach peak efficiency much quicker due to the pre-arranged routing of meter books.

3. Meter reading schedule can be maintained on a more efficient basis. Peaks in customers' accounting and billing can be promptly corrected.

4. Street name changes do not affect the account number.

5. Account number does not have to be changed unless a change is made in the meter reading sequence.

6. Route books can be maintained at point of maximum efficiency from a meter reading standpoint. Number of accounts in each meter book can be readily adjusted to meet expansion or contraction in the number of customers served in a given area.



CROWDS GROW when fields are lighted to permit games at night. Twelve 1,500-w floods on each of eight poles provide illumination for this Dexter (Mich.) high school field. The entire community worked on the project, which was backed financially by local businessmen

Small Communities Find Benefits In Sports Field Lighting

Since the war, hamlets and small towns have discovered a new source of municipal revenue in nighttime athletics—under lights. Why utilities should be interested, too, is evident from these case studies

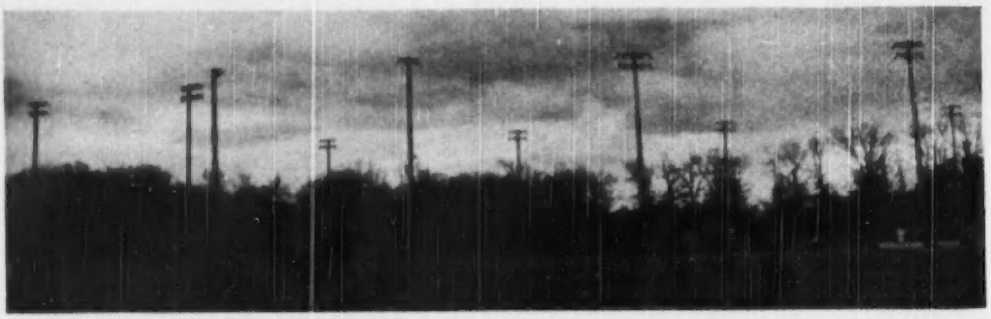
EDMUND W. PRATT
Lighting Division
The Detroit Edison Company

THOUGH the techniques were well understood and the equipment adequate long before World War II, the floodlighting of playfields for amateur football and baseball is largely a post-war development. In the 7,587 sq mi served by the Detroit Edison Co in southeastern Michigan, there were hardly more than a dozen lighted fields pre-war. They were found only in a few of the larger towns. Now a hamlet as small as Akron (pop 200) boasts of an adequate lighting installation for softball. The community without a lighted field is now the exception.

Consider the town of South Lyon (pop 1400). Though the idea of a lighted field had long been considered by sports-minded residents, nothing had been done about it until Rex Kinne, local theater proprietor, really pushed the idea early in 1947. He sounded out several groups in town and finally found the board of commerce most receptive. This organization issued $10,000 in unsecured and non-interest bearing bonds which were soon fully subscribed. The largest subscribers were the South Lyon Kiwanis, $1,500, the Village of South Lyon, $500, the Michigan Seamless Tube Co, South Lyon's largest industry, $500. The rest of the bonds were taken up by 200 individuals who bought in smaller amounts.

A lighting layout for a combination football-softball field was prepared by The Detroit Edison Co and the contract was let. The field was leased to the board of commerce for 5 yr, by the school district of Lyon Township, during which period the bonds are to be redeemed out of gate receipts. Following this, the complete lighting system will become the property of the school district. The method of choosing bonds for redemption as funds become available is interesting; choice is made by lot. Several bond holders have turned in their bonds and refused reimbursement when their names were drawn.

Construction, started in the spring of 1947, was complete in time for the fall football season at a total cost of $8,900. Gate receipts since then have averaged about $250 at each high school football game; admission charge, adults 65¢, children 25¢. Community use of the field has



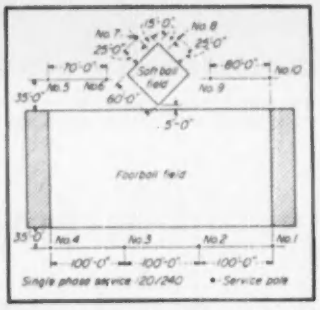
ILLUMINATION for this high school combination football-softball field in Keego Harbor consists of 74 1,500-w enclosed-type floodlights. It is one of 51 combination fields completed in Detroit Edison territory; 43 other fields have been lighted for one sport only

been even greater than anticipated with softball games in progress almost nightly during the summer. Scheduled softball games have not produced as much net profit as football, but have added to the total available for bond redemption. The field has been made available to any local organization at a nightly charge of $25, plus the cost of electricity. Some idea of the amount of use to which the field is put can be gained from the fact that during the summer electric service bills for lighting have averaged almost $100 a month.

The story of this South Lyon project is typical of the development of dozens of lighted playfields in the area; each community benefiting, first in the splendid spirit of cooperation which makes a lighted field a reality, and finally in the availability to young and old alike of a wholesome recreational center.

The village of Akron, in the Thumb area of Michigan, installed its lighted softball field in 1948. The $6,000 which it cost, was loaned to the Softball Association of Akron by the local bank. Another year like the first one will make it possible to pay off this loan in full. The field is lighted by 56 1,500-w open-type floodlights, and complete records for the 1949 season show that between June 15th and Sept. 27th the current consumption was 11,520 kwhr.

Roosevelt High School in Keego Harbor, a small town in the Lake district near Pontiac, acquired a combination football-softball lighting system in time for the 1948 football season. Seventy-four 1,500-w enclosed-type floodlights provide the illumination. Three home football games, played during the 1947 season before the lights were installed, resulted in a paid attendance of 375 and gate receipts of $124.50; three home games under the lights in the 1948 season resulted in a paid attendance of 2,296 and gate receipts of $1,163.39.



SPORTS LIGHTING LAYOUT for football and softball fields at South Lyon, Mich., was made by Detroit Edison lighting engineers. It provides 76 1,500-w, 105-v lamps operated at 115 v in closed medium-beam floodlights

In Wayne, Michigan, 20 mi from Detroit, lights were installed for the opening high school football game of the 1949 season; gate receipts the first night were over $1,500.

From town after town, reports indicate that attendance at a single game under lights has equalled attendance for an entire previous season of daytime games, with most of the increase made up of adult cash customers.

Of the 94 fields now completed in Detroit Edison territory, 16 are lighted for football, 24 for softball and 51 are combination fields lighted for softball or football. Three fields are lighted for hardball.

Metropolitan High School League (Detroit) reports an increase of $20,000 in football receipts during 1949 over the 1948 season, and credits the increase to night football. In 20 night games in 1949, receipts amounted to $50,000. Without night football, the league reported running into large deficits in 1947 and 1948.

This business has come on Detroit Edison's lines entirely unsolicited. The policy of the company has been to give all possible aid to any interested community when asked to do so. Lighting layouts and engineering specifications are provided without charge. It has been found that the number of lights recommended has been influenced more by the number of spectators expected than by the caliber of players; larger crowds require more light, as adequate vision at a greater distance from the players can be obtained only under higher levels of illumination.

Most pre-war fields used open-type reflectors, but Detroit Edison has encouraged a post-war trend to closed-type floodlights by recommending this type exclusively. It has been found that maintenance of designed illumination levels is poor with open equipment, and lamp breakage has been another adverse factor. The tendency to install closed-type equipment has become so strong, that fields originally equipped with open reflectors are being re-equipped with closed floodlights.

Recently some fields have been used for skating rinks in winter. Even though the full lighting load is not turned on, this represents an increased annual use of installed electrical capacity and a further social value to the community.

THE PROBLEM OF
SUBSTATION APPEARANCE
IN RESIDENTIAL AREAS IS
EASILY OVERCOME WHEN YOU
INSTALL GENERAL ELECTRIC
UNIT SUBSTATIONS . . . .
THEIR INTEGRATED DESIGN
MAKES THEM EASY TO LANDSCAPE
AND THUS OVERCOME
APPEARANCE OBJECTIONS.
ASK YOUR G-E REPRESENTATIVE
FOR BROCHURE GEA-5155
THAT SHOWS HOW OTHER
UTILITIES TOOK ADVANTAGE OF
G-E ENGINEERING AND SERVICE
(TWO EXAMPLES AT LEFT).
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GENERAL ELECTRIC

Macy's

San Francisco

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extreme flexibility

to handle load changes and future load growth

low installation cost

everything was shipped complete—as a unit—and easily installed

safety to personnel

no exposed circuits; metal encloses all current-carrying parts

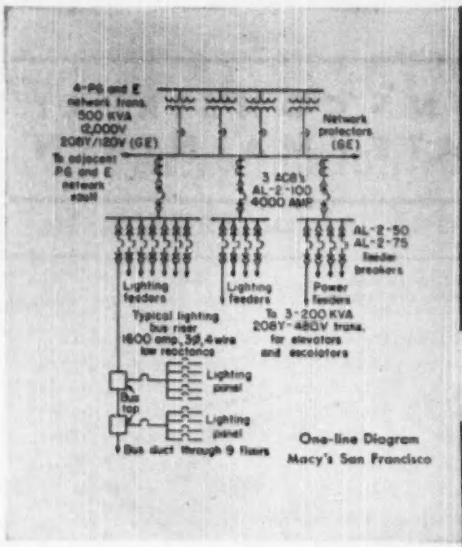
plenty of "IC"....with

100,000 amperes interrupting capacity, adequate to handle all short circuits

GENERAL ELECTRIC

HERE'S WHY . . . "In the department store business we cannot take any chances with power outages or potential fire hazards. We must also plan for expansion. That's why we wanted our power distribution system to be safe, to have adequate feeder and branch-circuit capacity, plus flexibility. General Electric switchgear gave us all these requirements."

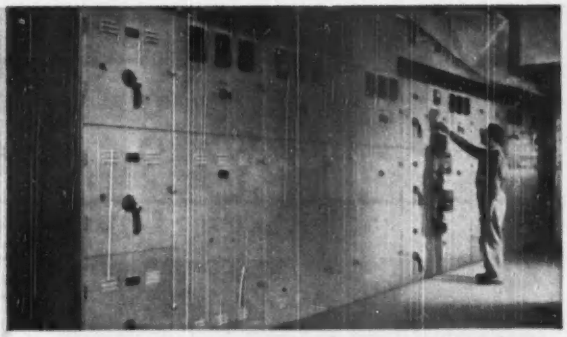
E. I. MOLLOY, VICE PRESIDENT
MACY'S, SAN FRANCISCO


4-PG and E network trans. 500 KVA (2,000V 208Y/120V (GE)
Network protectors (GE)
To adjacent PG and E network vault
3 4C8's AL-2-100 4000 AMP
AL-2-50 AL-2-75 feeder breakers
Lighting feeders
Lighting feeders
Power feeders
Typical lighting bus riser 1600 amp. 3ϕ,4-wire low reactance
To 3-200 KVA 208Y-480V trans. for elevators and escalators
Lighting panel
Bus top
Lighting panel
Bus duct through 9 floors

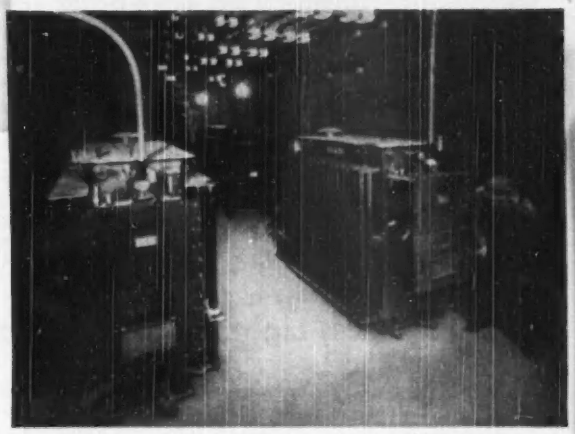
One-line Diagram
Macy's San Francisco

This, the largest switchgear installation to date in any San Francisco commercial building, adequately handles the power requirements that average four watts per square foot (nearly 500,000 square feet). Flexibility of the feeder system permits load changes without increasing the load on the switchgear. The 4000-ampere breakers have induction relay tripping.

Macy's installation is a complete General Electric project—switchgear, three 200-kva transformers for elevators and escalators, power and lighting panels, motors, and control for ventilating and boiler-room auxiliaries. One source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.



G-E metal-enclosed switchgear handles the incoming 120/208-volt power. The equipment is divided into three sections, two for lighting, one for power. Breakers (cascaded) are of the drawout type for ease of inspection and maintenance.



Four G-E network units, rated 500 kva, 12,000-120/208 volts in a Pacific Gas and Electric Company vault serve the building. Macy's 2500-kva load represents one of the largest loads added to PG&E's downtown network in recent years.

low-voltage SWITCHGEAR

Modern industrial power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want proper voltage for top performance of equipment, an extremely flexible setup to take care of expanding or changing loads, adequate short circuit protection, safety to personnel, and low installation and maintenance costs.

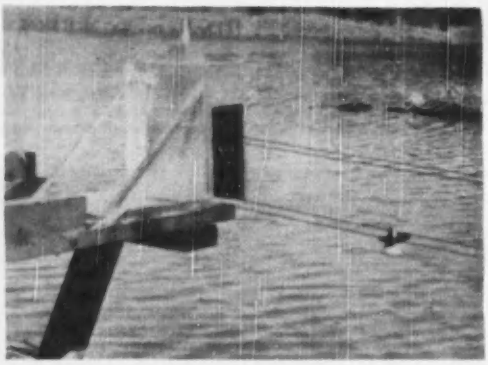
Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

Investigate today the many advantages of using General Electric switchgear in your plant for efficient, flexible power distribution. Contact your G-E sales representative for further information—and write for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

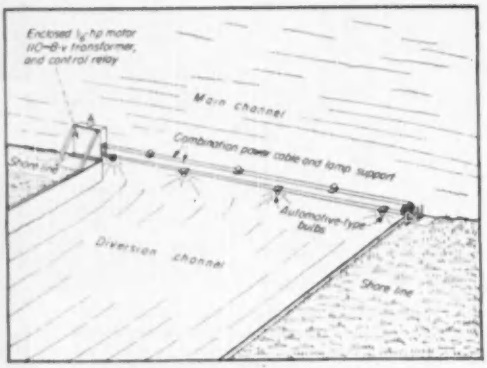
GEA-4966 Low-voltage Switchgear
GEA-3642 Air Circuit Breakers
GEA-2017 Network Protectors
GEA-3083 Metal-clad Switchgear
GEA-3592 Load-center Substations
GEA-3758 Load-center Distribution

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



FISH ATTRACTOR installed on San Joaquin River prevents fish from entering diversion channel. Automotive-type lights ride on a combination support and power cable moved by a 1/6-hp motor



ELECTRONIC RELAY automatically turns on the illuminated fish attractor unit when darkness approaches. Lamps, when turned upward on return trip, are de-energized by a mercury switch

Moving Lights Lure Fish Past Diversion Channels

MOVING lights suspended over entrances to power plant and irrigation diversion channels exert an almost hypnotic attraction on passing fish to guide them safely past the intake. Tests conducted over a three-year period by D. E. Fry, Jr., of the California Bureau of Fisheries, indicate that light has a more positive allure in redirecting fish to the main channel than do electric-shock warning devices.

One such automatic fish attractor, introduced by Electric Fish Screen Co of Hollywood, Calif., consists of a series of moving lights suspended across the diversion on two cables. The cables act both as support and power line for the lamps. Suspended several feet above the water, the cables move on insulated steel V-type pulleys. Actuating the pulleys is a 1/6-hp motor connected to a reduction gear through the V-belt and pulley combination. Power, stepped down from 110 v to 6-8 v, is transmitted to the pulleys by a brush mechanism. Thus each cable becomes a separate conductor, supplying lamps set at 15-ft centers and traveling about 10 fpm. An average installation uses 300 w.

Light fixtures are mounted on individual Micarta blocks clamped across parallel cables (see illustration). A floodlight effect, instead of spotlight coverage, is obtained with standard automotive bulbs mounted in a weatherproof fixture having a polished reflector and Lucite lens. A mercury switch controls each lamp, automatically shutting it off when the lamp faces upward.

Contained in the power unit is an electronic solar relay, automatically switching the unit on when darkness nears, off again as daylight approaches. Constant voltage is maintained with an automatic line voltage regulator.

Another type of light-allure consists of a chain of stationary lights which are progressively illuminated like a theater marquee, giving the illusion of movement. Still another type uses a revolving searchlight directed toward the water's surface.

Anchor and Guy Wire Sizes for Rural Service

A GUIDE to sizes of anchors and guy wires, and their applications with respect to rural lines, are outlined here as an adaptation from rural distribution standards of Gulf States Utilities Co, Beaumont, Texas.

Anchors Four sizes of anchors are standard in addition to the log or dead man anchor. These anchors are rated in holding power and are the plate or expanding types. In cases where poor ground exists it may be necessary to use a larger size than ordinarily called for. These standard anchors are:

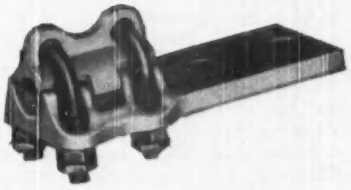
5,000-lb or 50-sq in. anchor—This anchor has a holding power of 5,000 lb in ordinary soil and is used with a

GENERAL ELECTRIC CONNECTORS

will carry the full-load current of EITHER cable, tubing or rod

SIMPLIFY YOUR INVENTORY

Only ONE G-E power connector is needed for any one size of conductor used—cable, tube or rod. This alone reduces your inventory—and saves you money—because there's no need to stock different connectors for every type of conductor.

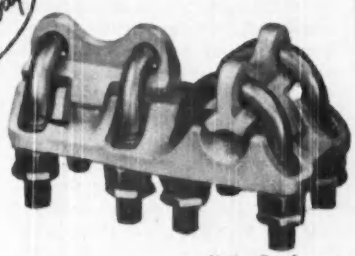


Disconnecting Switch Connector

FEWER CONNECTORS NEEDED

General Electric connectors will handle a greater range of conductor sizes. For instance, five G-E terminal connectors (shown top, right) will handle ALL 22 conductor sizes between 1/0 and 1¼ IPS. How many different connectors do you have in stock to take care of this range of conductor sizes?

why not check this right away?



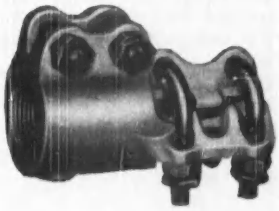
Station Tee Connector

SIMPLIFY ORDERING PROCEDURES

Each G-E connector has only one catalog number—and one price—regardless of the type of conductor for which it will be used. (And neither will you find two catalog numbers—and two prices—assigned to the same connector just because one is listed for use with tubing and the other for use with cable.) This will reduce your connector costs and simplify your ordering procedures by making it unnecessary to order several ordinary connectors when one G-E connector will do the job.

SAVE ORDERING TIME

With fewer connectors to order, you can order in less time. And G-E connectors are easier to order, too, for the simple reason that you don't have to specify so many different varieties to do the job.



Power Breaker Connector

Place an order today with your G-E sales representative and start realizing the many benefits to be gained by using General Electric connectors. Also, write for a copy of bulletin GEC-400 that contains 40 pages of valuable information on G-E connectors and see for yourself how easy they are to order. Write to *Apparatus Department, Section 856-53, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

½-in. x 6-ft. single thimble eye rod. This anchor is to be used on light strains where there is little possibility of adding circuits or increasing the strain materially.

10,000-lb or 90- to 100-sq in. anchor–This anchor is to be used with a ⅝-in. x 7-ft double thimble eye rod. This anchor is the normal distribution anchor and is to be used with 1¾-in. or 2¼-in. guy wires.

16,000-lb or 140- to 160-sq in. anchor–This anchor is to be used with a ¾ in. x 8 ft double thimble eye rod and will hold 1½-in. or 2¾-in. guy wires.

40,000-lb or 400-sq in. anchor–This anchor is to be used with a 1 in. x 10 ft thimble eye rod and will hold up to 2½-in. guy wires.

Log or Dead Man Anchors–This anchor is to be used in place of the 40,000-lb anchor or in soft ground where extra holding power is required. The log is to be 8 in. x 6 ft and is to be used with 1-in. x 10-ft double thimble eye rod, which will serve to identify it as at least a 40,000-lb anchor.

Each anchor uses a different size rod which will indicate the size of anchor in the ground after installation. The 40,000-lb patent anchor and the log anchor should be considered as at least equal.

A few other types of anchors are available for special installations in swamps and hard soils where the standard anchors cannot be suitably applied.

The size of anchor required is readily determined from use of guy chart. The anchor should have holding power at least equal to the strength of guy wire selected.

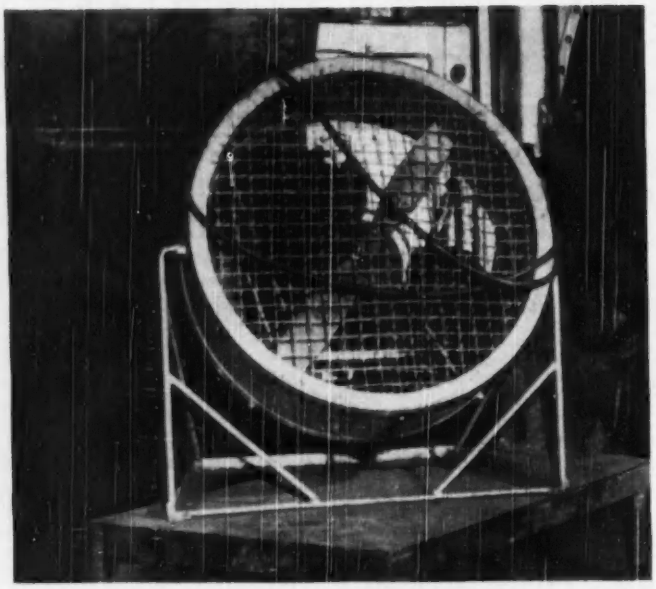
Guy Wire Three sizes of guy wire are considered standard as follows:

¼-in. Siemens Martin–To be used with light 5,000-lb anchor for arm guys and for double or triple guys on larger anchors when it is desirable to divide the strain.

⅜-in. Siemens Martin–This is the most common size of guy wire for use on urban systems and may be used singly on the 10,000-lb anchor or double on the 16,000-lb anchor.

½-in. Siemens Martin–This guy wire is for use only on the heaviest loads and may be used singly on the 16,000-lb anchor or double on the 40,000-lb anchor or dead man.

Portable Fans Save Time In Powerhouse



PORTABLE FANS are provided by Toledo Edison for cooling areas where men work in powerhouses. Areas around heaters, boilers, and turbines are cooled by these fans which have long extension cords. By using them the men can start working on equipment while it is cooling—thus saving time. Fans are moved around on dollies with retractable wheels

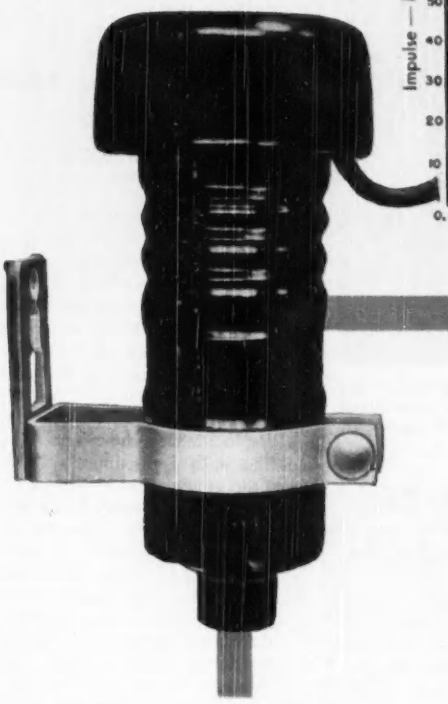
Numbers Help Locate Cars Quickly

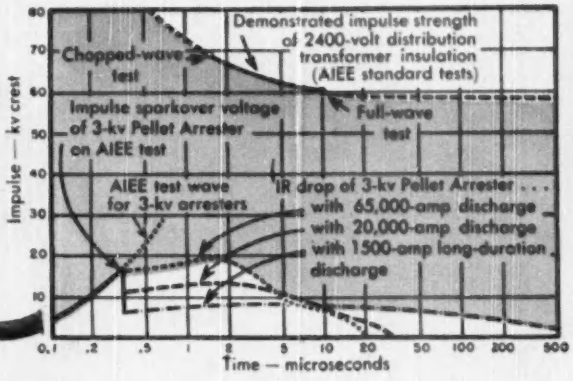
NO TIME is lost by The Dayton Power and Light Co men in finding their proper cars in the company parking lot now that company numbers have been installed on roofs of the cars

No other distribution arrester

Protects

. . . so well





The G-E Pellet arrester is also "tops" for endurance. It is the *only* distribution arrester with series gaps sealed in dry, inert nitrogen (N_2)—keeping gap electrodes bright as new during years of service operation. Pellets, themselves, are of lead peroxide—a distinctive valve element, self-protecting against service moisture—unaffected by condensation, or humidity. Pellet arresters have large discharge capacity—they withstand easily the AIEE and NEMA standard 65,000 ampere impulse test.

This graph, made from actual volt-time and ampere-time cathode-ray oscillograms, demonstrates the protection afforded distribution transformers by the G-E Pellet arrester. No other distribution arrester limits lightning voltages so low for small, medium or high lightning currents.

This co-ordination chart is based on the 3-kv arrester protecting a 2400-volt transformer. Similar charts for Pellet arresters of higher ratings protecting higher voltage class transformers demonstrate the same advantages in unequaled margin of safety in protection. This *extra protection* results from the combination of low sparkover voltage and exceptionally low IR drop, that together hold lightning voltages to lower levels than does any other distribution arrester.

You buy better protection when you buy Pellet arresters! The Quality-Standard of the industry for more than 25 years.

Apparatus Department, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

METER SELECTION is a simple task in a truck equipped with a "Lazy Daisy." This rotating device holds 72 meters and permits the meterman to obtain the desired meter without getting into the truck and plowing through a mass of meters to find a meter of required size

Handling Meters Made Convenient With "Lazy Daisy"

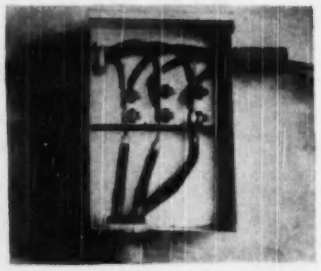
V. M. SPRANGEL
Meter Superintendent
Public Service Co of Oklahoma, Tulsa

METER TRUCK of Public Service Co of Oklahoma, equipped with "Lazy Daisy" has made meter handling more convenient. The "Lazy Daisy" is a rotating device similar to the old fashioned food wheel of that name. It fits into the panel truck and its compartments will carry 72 watthour meters.

The carrier is mounted on a ball bearing spindle, permitting the meterman to select the desired instrument without getting into the truck and moving a number of meters. In this manner, a truck carries more meters and time is saved in selecting the desired meter on a routine change-out program.

Flexible Use of Personnel Aided by Training Program

THE electric production department of Consolidated Edison Co of New York, Inc, has launched a centrally coordinated training program for the department's personnel. The training is intended to give employees a broader understanding of power plant operation as well as a good understanding of company policies and benefits affecting all employees. This program possesses a great value which cannot be measured in dollars and cents. It makes for more flexible use of personnel and a higher level of morale, and it should be quite evident that both these elements eventually find a place in the financial reports of a company.



OUTGOING CIRCUITS can be added or removed easily from these unit buses used for terminating underground cable

Unit Bus is Terminal For Underground Cable

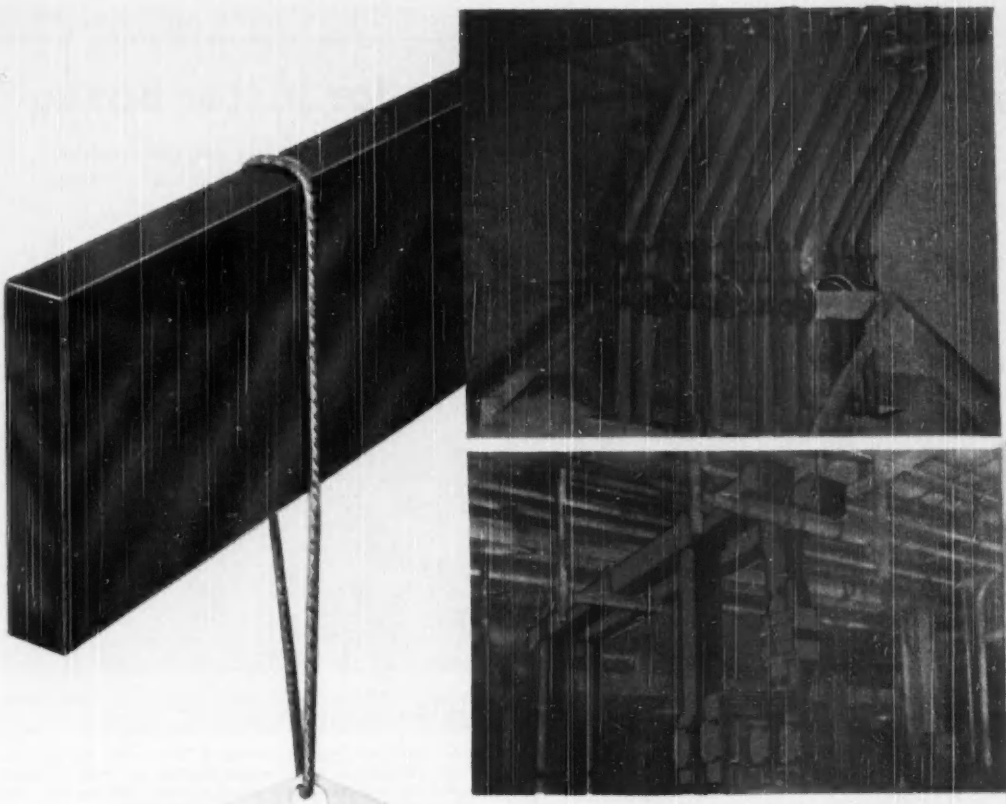
H. S. CHRISTENSEN
Supervisor of Underground
Southern California Edison Co
Los Angeles

WHEN CONVERTING an overhead distribution area to underground, it is often necessary to combine several existing overhead services into one underground service. To add or remove services without disturbing other services, an open bus in a "raintite" pull can is used by Southern California Edison Co to terminate underground cable. These pull cans are 12x18x6 in. and are mounted on building walls approximately 14 ft above the ground level.

The cables are terminated in a unit bus which has a stem about 10 in. long used as a bus to which the services are connected. These unit buses are connected to the cables by means of a hydraulic press. They are supported by a bakelite brace, as shown, to allow 3± in. on 110 or 220 v between energized parts and the can.

When paper and lead cable is used, the end of the cable is oil-stopped by means of silk tape and insulating varnish with a final covering of thermoplastic insulating tape. Services are connected to the bus by means of split bolt connectors or unit connectors. This type installation is used on cables up to 500 Mcm maximum size.

This method of terminating underground services requires no more time to install as it eliminates taping over large connectors. The open bus greatly facilitates the addition or removal of services as no taping is required and the work may be done with all services energized.



REVERE
really knows
BUS BAR

BECAUSE of its superior electrical and heat conductivity, Revere Bus Bar is your logical choice for bus connections, switch and panel boards, circuit breakers and power feed systems in general. No other commercial metal approaches electrolytic copper in its ability to carry electricity. Having the highest thermal conductivity of any commercial metal, copper offers the greatest ease of cooling. Furthermore, joints of high electrical conductivity are readily made by soldering, brazing, or bolting. Because of its low coefficient of thermal expansion, copper bus bar minimizes design difficulties in providing for changes in length due to temperature changes. An added advantage: high scrap value of the metal when plant changes necessitate a new system of buses. For information on Revere Bus Bar, consult the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

• •

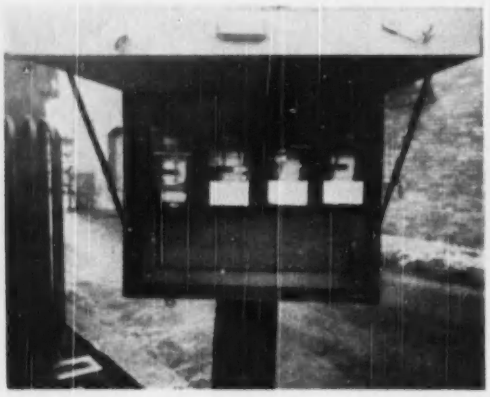
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

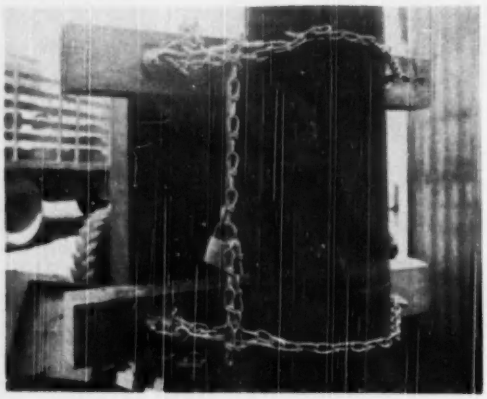
Temporary Mountings for Meter Boxes

Where load surveys or temporary services are required, illustrated temporary and semi-permanent mountings permit flexibility of location, reduced installation time, stability, and salvage on removal

C. C. LINARD, Meter Department, The Ohio Power Co, Bellaire, Ohio

TEMPORARY MOUNTING



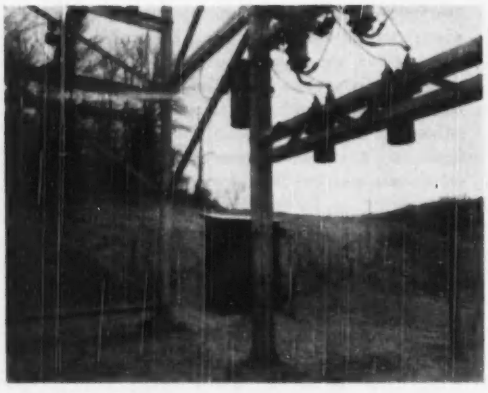


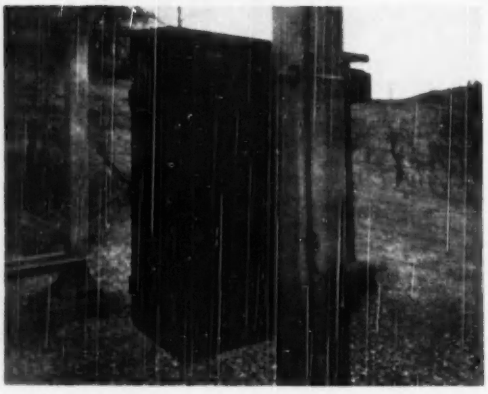
INSTRUMENT BOX is mounted temporarily on pole for load and voltage surveys. The meter box is a stock item normally used for metering. At right, box is bolted to two suitable mounting cross pieces and porch-swing chain is used for fastening to pole

FOR FASTENING a meter box to a pole the method illustrated requires about 2 min time. Material consists of two 30-in. pieces of crossarm, eight ⅝ x 4½ in. machine bolts, four pigtail hooks, two 4-ft pieces of porch-swing chain, two ⅝-in. turnbuckles, one ½ x 32 in. locking rod with a 1-in. eye in the center, and one padlock.

The arms with their pigtail hooks (spaced for poles up to 18 in. diam) are bolted to the instrument box (or other equipment temporarily required) prior to raising it into position on the pole. There, the chain is looped around the pole and over the pigtail hooks; the turnbuckles are attached to those hooks and the chain, and then tightened. To prevent loosening of the turnbuckles by unauthorized persons, the locking rod is passed through the pair of turnbuckles and secured in this position by locking the eye to the chain as shown.

SEMI-PERMANENT MOUNTING

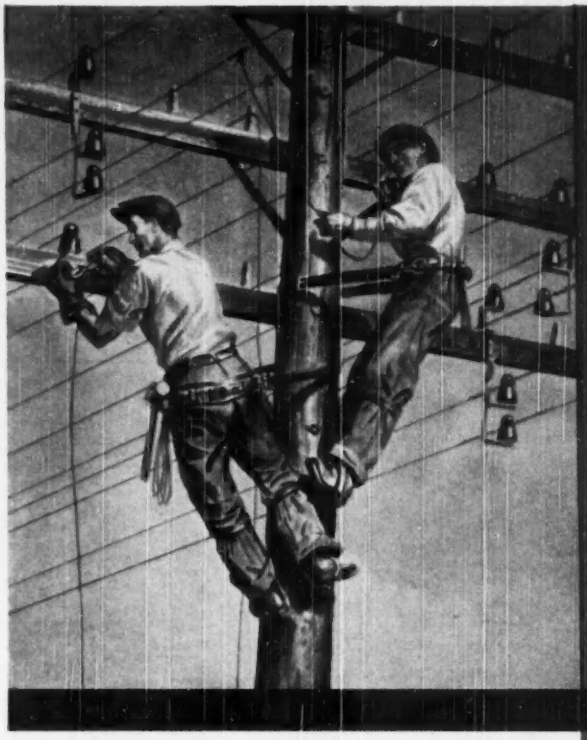




INSTRUMENT BOX has semi-permanent mounting on vertical structure which must not be drilled

THIS METHOD of mounting an instrument box on a rectangular-section member of a vertical structure (either steel or wood) is used where conditions do not permit drilling the vertical structure. The method produces a clean cut installation, utilizing a double grip on the vertical structure and standard stock items.

Material requirement consists of two short pieces of crossarm, two-eyebolts and two machine bolts, all sizes depending on the dimensions of the instrument box and vertical member. The hooked-shaped straps on the top rear of the box hang on the upper crossarm; the lower arm is bolted to the box.



for clean crossarms that last longer!

Specify penta-protected Crossarms

chlorophenol

Here's one way to cut maintenance costs. Specify PENTA-treatment for all crossarms. A low-cost PENTA-treatment gives crossarms effective protection against pin hole decay and end rot, chief causes of crossarm replacement.

PENTA's low solubility and volatility mean less leaching and "cooking" out under adverse climatic conditions—assure long lasting protection.

Men like to work with "PENTA-treated" wood. It's clean, easy to handle and nonirritating.

For technical information about PENTAchlorophenol, consult your treater or write to Dow, Dept. PE 14A.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

THE CLEAN WOOD PRESERVATIVE

DOW penta- chlorophenol

A Method for Estimating Requirements Of Transformer Cooling Air

TYLER G. HICKS
Summit, New York

Chart permits quick estimates of air quantities, also allowable total kilowatt loss of transformers, and is useful for performance checks, design estimates, and comparison of various units of transformers.

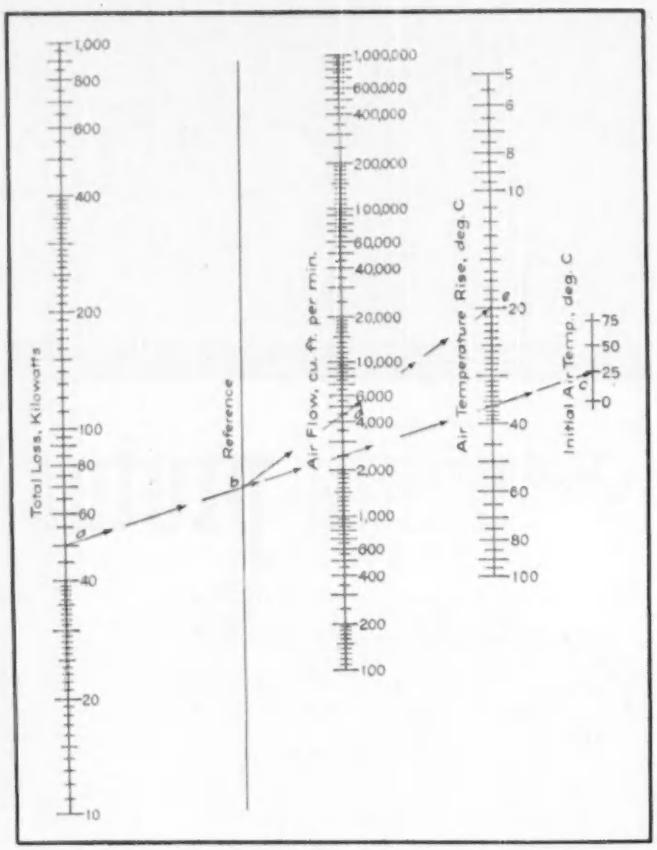


Chart is based on the relation*:

$$Q = K_t L/T$$

where Q = required air flow, cubic feet per minute
K_t = a constant depending on air temperature; it varies from 1.65 at 0 C to 2.10 at 75 C
L = total loss, watts
T = air temperature rise during cooling, deg C

EXAMPLE FOR USE OF CHART

Problem: Air at an initial temperature of 25 C is used to cool a transformer having a 50 kw loss. What air flow is required when air temperature rises 20 C during passage through the transformer?

Solution: Enter the chart at a 50 kw loss and project across to 25 C, (abc). From the intersection (b) with the reference line, project to 20 C temperature rise, bde.

Result: At (d) read 4,500 cfm, required air flow.

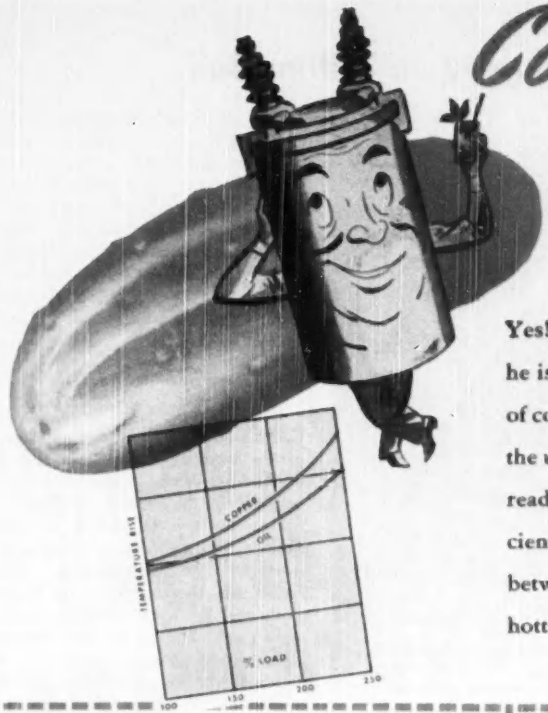
The rule of thumb for air cooling of transformers states that about 150 cfm of air should be circulated for every kilowatt of total loss. A more exact statement of cooling air requirements is the above equation.

Use of the rule of thumb in this instance would have given 50 kw (150 cfm) = 7,500 cfm, a value which is somewhat high.

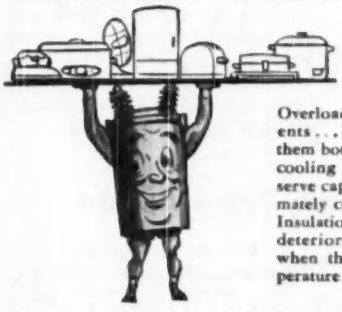
By reversing the solution path, this chart can be used to find the allowable total loss for a given air flow, temperature rise, and initial temperature.

* Equation and constants used in plotting this chart can be checked in STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS, McGraw-Hill Book Co., 1949; Sect. 6, par 73, Eq (6-37).

Cool as a CUCUMBER!

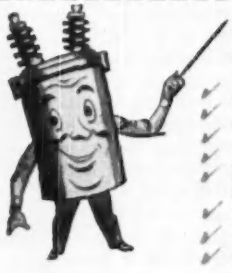


Yes! "Hi" HiperCore is cool as a cucumber, because he is designed to be cool. He is made with a core of cold-rolled, oriented silicon steel which permits the use of a smaller, narrower, and therefore more readily cooled coil. His numerous and more efficient cooling ducts provide greater contact area between the winding and the oil resulting in lower hottest-spot-over-oil temperature.



Overloads or High Ambients . . . HiperCores take them both in stride. Better cooling means greater reserve capacity for that ultimately certain emergency. Insulation materials in oil deteriorate more slowly when the operating temperature is reduced.

HiperCore Transformers will provide longer, trouble-free service than older style transformers. HiperCores have a longer life expectancy, thanks to advanced Surge-Tested Design and the use of a high factor-of-safety in the application of the insulating materials.

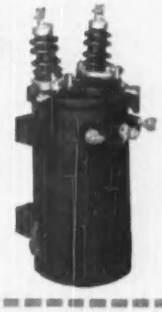


CHECK HIPERCORE PLUS FEATURES!

- Lower Hottest-Spot-Over-Oil Temperature
- Longer Operating Life
- High Factor-of-Safety in Design
- Lighter Weight
- Smaller Size
- Greater Short-Time Overload Capacity
- Better Voltage Regulation
- Superior Tap Changer

HiperCore

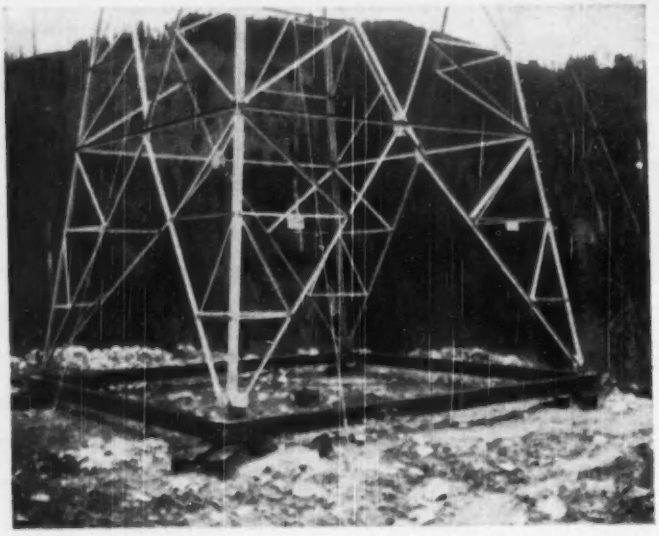
Photo shows 5 Kva, 7200 to 120/240 volts Conventional Type HiperCore Transformer. HiperCore Transformers range in size from 3 Kva to 50 Kva inclusive. Write for Bulletin H-303 for complete information about HiperCore Transformers.



MOLONEY ELECTRIC COMPANY

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONTARIO, CANADA

Steel Towers Floated on Shifting Soil



FLOATING TOWERS, resting on mobile footings and guyed in four directions, have been used by Bonneville Power Administration in a bad slide area. Towers are checked and realigned as necessary every 30-45 days during the rainy season by using jacks and winches

If transmission towers cannot be anchored firmly because of poor soil conditions, it may be feasible to float them and maintain alignment by guying. Bonneville Power Administration has used this method on a 230-kv line which crosses a bad slide area.

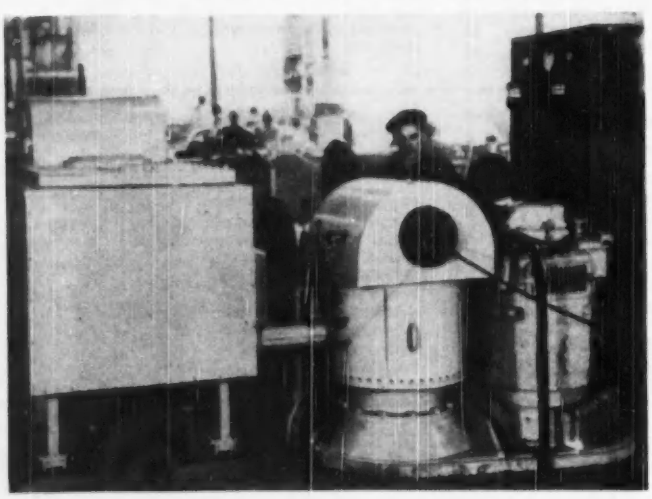
In the area the surface layer of rock and earth moves as much as two to three feet during the annual rainy season. Geologists have attributed the movement to an underlying layer of clay. When lubricated by rain, the clay allows the upper layer of earth and gravel to move down the slope. Both lateral movement and some tipping of towers was involved in about 6,000 ft of the slide area, seriously affecting alignment and tension of the line.

Frame Mounted on Skids

Investigation of the problem, by C. Miller, L. Duffy and L. Murray of the branch of maintenance and F. W. Farr of the branch of design, resulted in the scheme to float the towers on top of the slide area. Towers were bolted to a base framework of 12x12-in. timbers. This frame was then mounted on heavy skids and the towers anchored with eight guys. During the rainy season each tower is checked every 30 to 45 days and any tipping or lateral movement is easily corrected by loosening the guys and using jacks and bulldozer winches to put the towers back in position. Five towers have been equipped with the mobile bases, and others will be similarly equipped as they are affected.

Continuous Press Applies Load at High Temperature

BROR O. N. HANSSON
Aktiebolaget Liljeholmens Kabelfabrik
Stockholm, Sweden



ONE MAN operates this continuous lead extruder driven by a 6½-kw motor

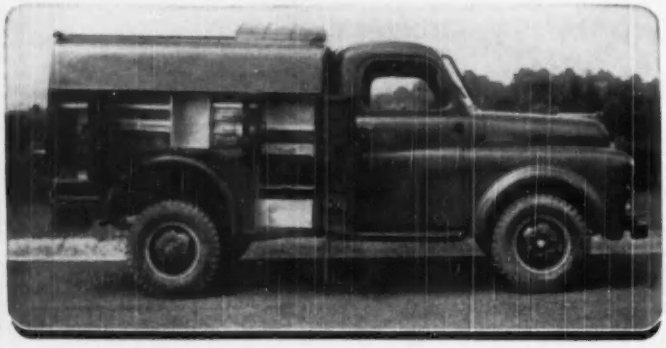
Higher than usual temperature of the lead in the die block of a continuous press has the advantage of; (1) making a superior weld and (2) lowering the friction to decrease the stress on the feed screw and its thrust bearing. At the same time the power consumption is reduced. The extra 100 C of lead temperature exists only in the die block. At the extrusion exit the lead is cooled to normal extrusion temperature suitable for the strength of the lead pipe and to avoid injury to insulation on the cable.

The press shown has a screw of 90 mm and is driven by 6½-kw motor adjustable over the speed range from 430 to 1,425 rpm. For small size

This Veteran of Two Wars
Has Made O-B the Logical
CHOICE OF
INSULATORS
You may remember—there was also a metal shortage during World War I. This accounts for the wood bottoms and steel tops of these towers, erected in 1918, and still so satisfactory there has been no good reason to rebuild the line. Equally satisfactory is the O-B insulation, installed 32 years ago, and providing just as reliable protection as the day it was originally put up.
Insulator performance of this character has accounted for many other transmission lines, subsequently built by this southern property, to be O-B equipped. Such reliability, proved out on the user's own terms, has made O-B the logical CHOICE OF INSULATORS.
Ohio Brass
MANSFIELD • OHIO
3080-H

YORK-HOOVER

Service Bodies *SAVE MONEY* for YOU because



Model 2040

York-Hoover Line Service Bodies, for installation on ¾-1 ton chassis, are provided with complete working equipment.
Years of study and engineering experience have indicated the most adequate body interior arrangements so that all necessary service materials and tools are at the service men's fingertips.
There is a York-Hoover body design to meet your particular requirements and we will be happy to give you all details.

Write now for the York-Hoover "Public Utility" catalog.

1. All-metal body structure is balanced to produce minimum weight.
2. Exclusive body framework and assembly details result in many extra years of service.
3. Construction includes replacement parts study for maintenance economy.
4. Details of convenience for driver and garage personnel carefully considered.
5. Your body is engineered for your specific job — and yours alone.

YORK-HOOVER BODY DIVISION CORPORATION

YORK, PENNA

cable this press will give the same output as an intermittent action hydraulic press which would require 3-4 men (instead of one) and need a 65-hp motor. A larger continuous press extrudes 44 lb of lead per minute. The lead supply is fed in at right angles to the cable.

Fuller details about this press are given in the Aug. 6, 1949, issue of *Teknisk Tidskrift*.

•

MOBILE CRANE, driven to substation locations, speeds transformer inspection and cleaning. Crane lifts coils out of the housing, thus saving hauling of transformers to shop

Mobile Crane Aids Transformer Maintenance

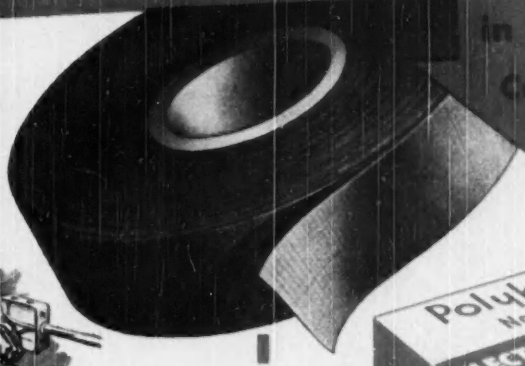
S. M. HAMILL, JR.
Manager, Electric Operating Dept
The Cincinnati Gas & Electric Co
Cincinnati

INSPECTION and cleaning of power transformers in isolated substations can be done simply and economically through the use of a mobile lifting device. This practice eliminates the cost of loading and unloading transformers and transporting them to and from the shop.

The Cincinnati Gas & Electric Co uses a mobile crane to meet the necessary lifting requirements when untanking transformers at outlying lo-

NOW... from your electrical dealer...
get Polyken No. 163 ELECTRICAL TAPE

in these 3 Convenient Packs



...beats "friction tape" 8 ways!

...gives you 8 "extras" at no extra cost!

- **Sticks quicker (higher "tack")**
- **Greater dielectric strength**
- **Cleaner than friction tape. Doesn't pick up dirt or soil hands**
- **Unwinds easier**
- **Doesn't fray**
- **Less bulky, adequate yet strong**
- **Better moisture barrier**
- **Sticks firmly to any clean surface**

Now . . . for no more than you have been paying for ordinary friction tape . . . your electrical dealer will supply you with 8-ways-better **POLYKEN** No. 163 electrical tape . . . in your choice of three convenient put-ups.

A thin but tremendously strong cloth-backed tape, No. 163 is a pleasure to work with. It unwinds easily, sticks quickly, firmly. The cloth backing is *not* sticky. Thinness plus high dielectric strength means neater, less bulky splices and wraps. Yet No. 163 costs you no more than most ASTM friction tape.

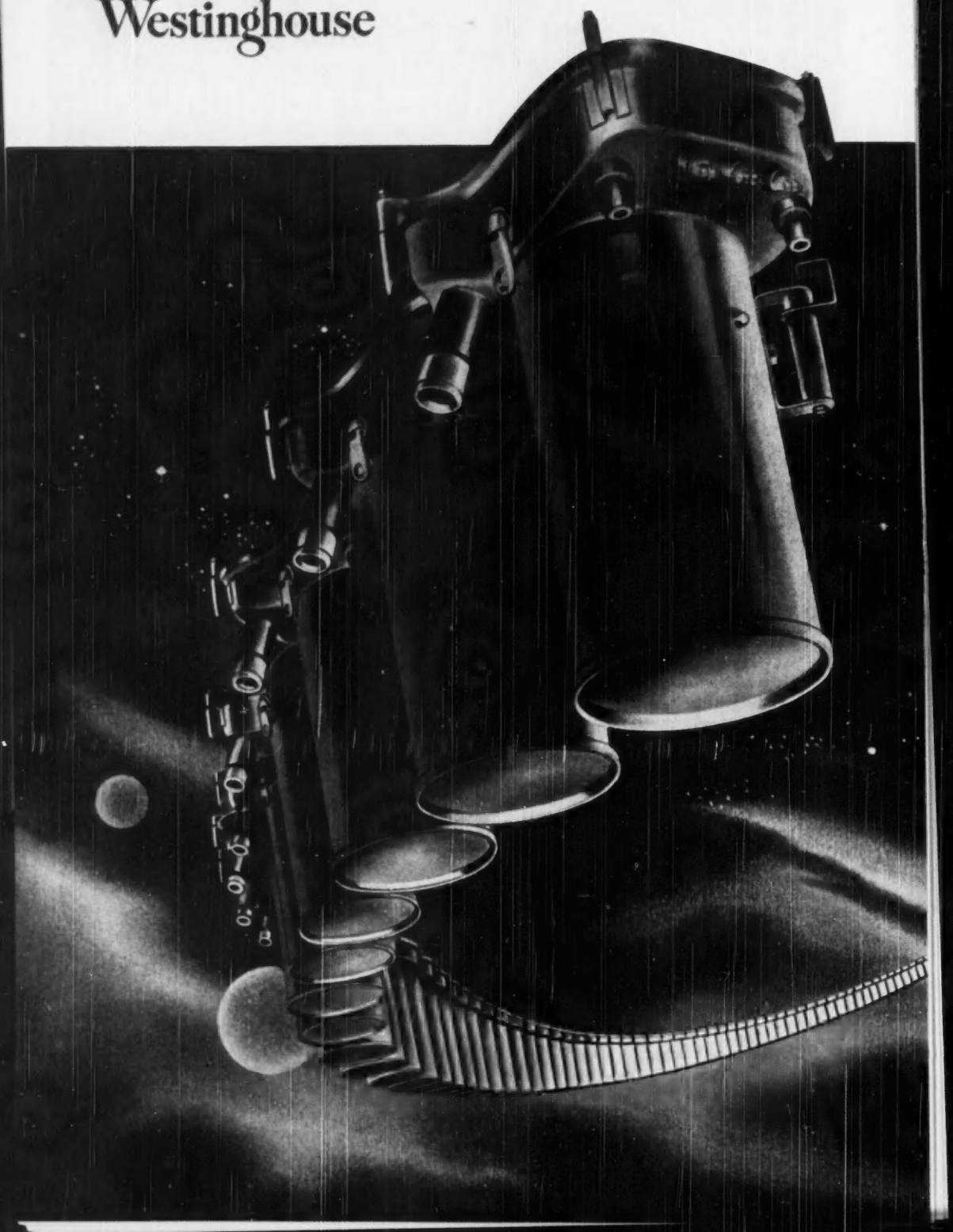
Call your electrical dealer today!

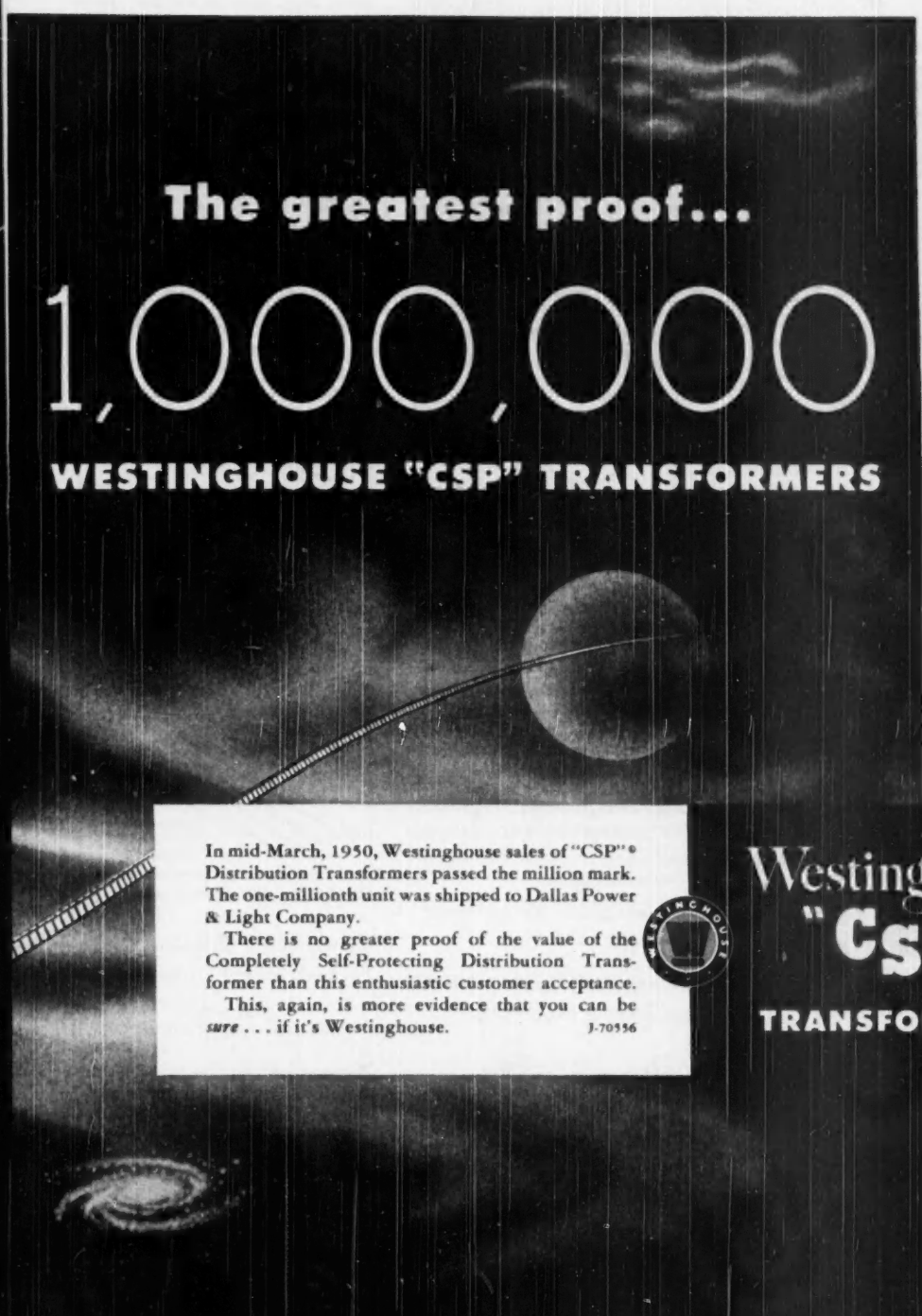
Polyken®
INDUSTRIAL TAPE

DEPARTMENT OF
BAUER & BLACK
DIVISION OF THE KENDALL COMPANY
222 W. ADAMS ST., CHICAGO 6

YOU CAN BE **SURE**.. IF IT'S

Westinghouse





In mid-March, 1950, Westinghouse sales of "CSP"® Distribution Transformers passed the million mark. The one-millionth unit was shipped to Dallas Power & Light Company.

There is no greater proof of the value of the Completely Self-Protecting Distribution Transformer than this enthusiastic customer acceptance.

This, again, is more evidence that you can be *sure* . . . if it's Westinghouse. J-70556

Westinghouse
"CSP"
TRANSFORMERS

NEW 4 foot SLIMLINE GUTHLITE*

sets all-time low in upkeep!

It's *downright* economical how the patented GUTHLITE "jacknifes" down and its single-pin 4-FT. SLIMLINE lamps are changed with a quick *push-pull*. Even easier than replacing incandescent bulbs—and it's all done right from the floor *without ladders!*

Maximum use of light user pays for: 4-FT. SLIMLINE GUTHLITE'S lamps are so accessible—cleaning so practical—it's easy to keep light-stealing dust on lamps to a minimum.

No starter switches, so no starter troubles—saves extra parts, maintenance and lamps.

Light-at-the-click-of-the-switch—no uncertain starts. And 4-FT. SLIMLINE GUTHLITES bring you the latest development in high-efficiency light sources—4-FT. SLIMLINE lamps.

May we send Bulletin 845-SH with full details?

Guth LIGHTING

THE EDWIN F. GUTH COMPANY ST. LOUIS 3, MISSOURI

Leaders in Lighting Since 1902

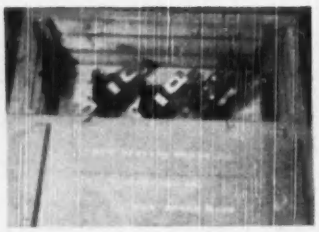
LIGHTING SIMPLIFIED

NEW GUTH 4-FT. SLIMLINE SYSTEM is now available in *every 2 and 4—40W fixture in our complete line.* For the whole story, call in your nearest GUTH Resident Engineer or write us.

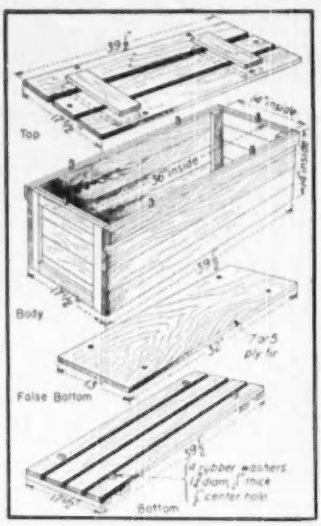
cations. With the transformer bushings and cover removed, the core and coils are lifted out, cleaned and inspected. After the transformer is reassembled, the crane is released for other work.

Since this mobile crane can be moved from one location to another with considerable ease and in a relatively short time, its use has been a great time saver as well as a most economical method of inspecting and cleaning power transformers.

•



SHIPPING CRATE open and showing three instrument transformers ready for shipment



EXPLODED VIEW of crate assembly

Home-Made Shipping Crate For Instrument Transformers

J. A. WOOD
Salem (Mass.) Electric Lighting Co

SHIPPING varied shapes of instrument transformers between operating companies and the central laboratory of the New England Electric System at Worcester, Mass., for peri-

odic testing posed a problem. Proper protection initially requires factory crates to be tailored to fit each unit. In many cases such crates after receipt by an operating company were dismantled and destroyed, because the next shipment was almost certain to be units of a totally different style, shape and size.

Therefore a simple box having a removable bottom was first suggested. This was developed into a crate style box with a false bottom and easily removable lid. Wood is 1-in. fir or pine of crating lumber grade, finished on sides and of random widths. Screws are used instead of nails to make replacement of broken slats easier. Instrument transformers undergoing shipment are bolted to the false bottom, a piece of 7-ply, ½-in. fir plywood which in turn is fastened to the crate bottom with four round-head carriage bolts. Four rubber washers between the false and true bottoms act as shock absorbers. Plywood was selected for the transformer support because of the many holes which can be made in it without seriously weakening the false bottom, and as it can easily be discarded and replaced.

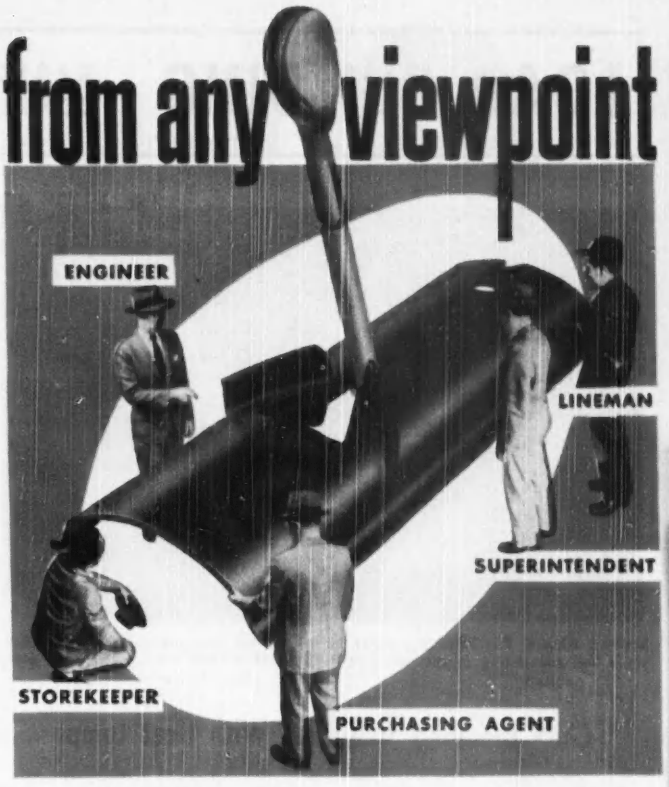
The crate top is reversible end for end and side over side. It is held in place by six carriage bolts equipped with wing nuts having provision for wire seals. One side of the crate top is stenciled with shipping directions to the central laboratory. The other side carries similar directions for return to the operating company.

•

Index of Employees Location Frees Phones

RECENTLY Hartford (Conn.) Electric Light Co set up a complete index, covering every employee, for use by operators at the headquarters switchboard. The index lists the employee's department and its location, whether it be in the offices, service station, power plants or substations.

This system replaces the old method of telephoning various departments to locate someone whose name wasn't familiar to main switchboard operators. Considerable time is saved by reducing tie-ups of telephone trunks and branch lines formerly held intact while operators looked for the employee's location.



New CHANCE Nevercreep

is the best plate ever!

For the greatest possible line security under normal guying conditions—choose the Chance Nevercreep Anchor—it pulls entirely against solid, undisturbed earth.

The New Chance Nevercreep is better from any viewpoint... **Engineers** like the reinforced steel construction with the triple-welded plate that strengthens the area of greatest pull and the dual-purpose creep guards that keep the anchor from creeping up the hole. **Lineman** find the Nevercreep easier to install—the new, larger opening simplifies slipping the anchor over the point of the rod and the creep guards act as a guide for hanging the anchor. The Nevercreep can be installed in machine-bored holes... a definite saving in labor that appeals to **Superintendents.** Lighter weight, ease of handling and stacking are features that **Storekeepers** appreciate... and **Purchasing Agents** get all these advantages without extra cost!

Write for complete information and prices.

ABC Industries

You know it's RIGHT when you specify CHANCE

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

LOAD BUILDING

RESIDENTIAL • RURAL
COMMERCIAL • INDUSTRIAL

SIMPLE CHICK BROODER is provided by hanging two heat lamps approximately 2 ft above floor and forming an enclosure 5 ft in diam with a draft shield of corrugated paper

Chick Brooding Simplified With Heat Lamps

SIMPLICITY is the important feature of heat lamp chick brooding. For setting up such a brooder a poultry raiser just hangs a pair of heat lamps in metal reflectors about 2 ft above the litter. A length of corrugated paper draft shield is then set up to make an enclosure, roughly 5 ft in diam. Feeders and waterers are placed in the enclosure, partially within the circles of light. Diameter of the circle is gradually increased as the chicks grow.

With this arrangement it is possible to brood up to 500 baby chicks at one time. There are numerous advantages such as elimination of stove with its flue connections and the associated tending and cleaning around the stove. Furthermore, there is no hover to raise and clean under and the litter is always dry.

Chick losses are way below the usual average. This is believed to be at least partially due to elimination of the tendency of some chicks to stay under the hover until they die of starvation. The heat lamps furnish a certain amount of light and this apparently encourages the chicks to eat more frequently and, consequently, to develop faster.

Two heat lamps are recommended for the brooder as a safety factor—even when there are only small batches of chicks. Then, if one lamp should burn out during the night, the chicks will still be protected.

Refresher Course Builds Enthusiasm for Better Lighting

M. R. NORTON
Dealer Sales Promotion Manager
Wisconsin Power & Light Co
Madison

BETTER WIRING has been fostered by teaching fundamentals to wiremen in Wisconsin Power and Light Co territory through a wiring refresher course. Need for knowing more about fundamentals of wiring was expressed by contractors in the area soon after the end of the war. The course has helped reduce the problems resulting from inadequate wiring and poor workmanship.

Put on by Wisconsin Power & Light Co and by vocational schools in the area, the wiring refresher course has clicked beyond expectations. Need for the training was particularly great in the smaller communities. Only in the four largest cities (25,000 to 40,000 population) is there any arrangement for licensing or inspection.

The wiring refresher course was given to electricians in five two-hour evening sessions, one each week for five successive weeks. It was built around the state electrical code as a text, and with ten talking movies on electrical wiring. These inexpensive films were developed during the war by the U. S. Department of Education, and proved very satisfactory.

Instructors were provided by the nearest vocational school under varying financial arrangements. The company furnished places to meet, the films and projector, together with a half hour presentation on wiring adequacy at each meeting. Invitations and announcements were sent out by the company.

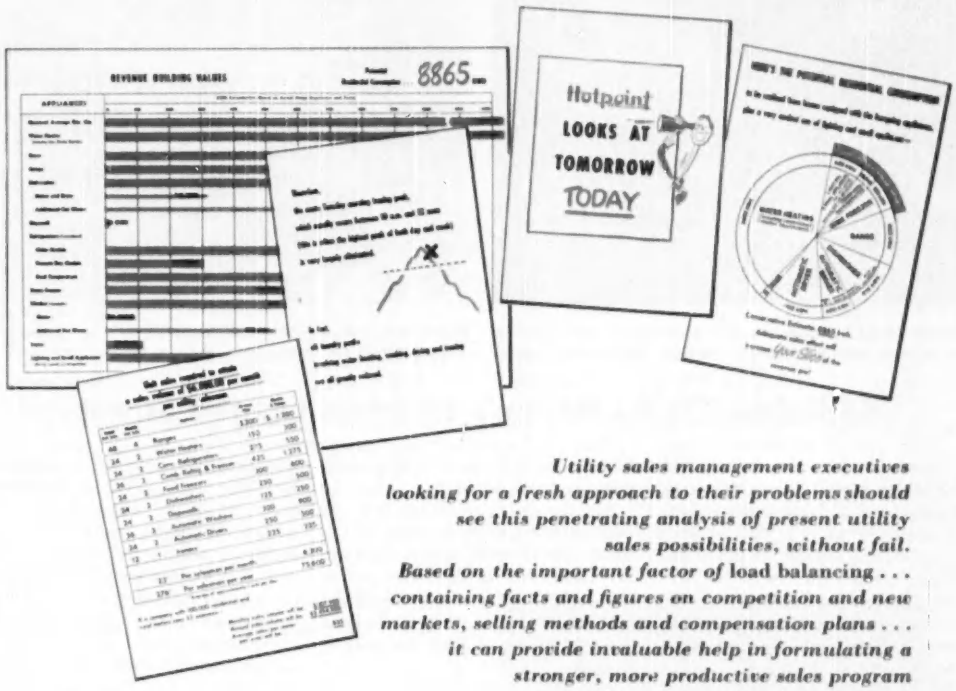
Five hundred and fifty wiremen in a dozen of the company's fourteen districts have attended these courses. Best evidence of their approval is shown by their attendance. Succeeding weekly sessions in each district showed larger attendance, the high point coming at the fourth meeting, the one on farm wiring. Interest was more keen in districts where most of the communities are under 20,000 population, because fewer of the rural and small city electricians have had training at vocational or trade schools.

When the first session was called to order at Baraboo, company representatives stood ready with a handful

"One of the most thought-provoking presentations it has been my pleasure to hear."

CARL T. BREMICKER
Vice President in Charge of Sales
Northern States Power Company
Minneapolis, Minnesota

... a new and thoughtful "balanced load" study designed expressly to meet today's utility sales objectives



Utility sales management executives looking for a fresh approach to their problems should see this penetrating analysis of present utility sales possibilities, without fail. Based on the important factor of load balancing *... containing facts and figures on competition and new markets, selling methods and compensation plans ... it can provide invaluable help in formulating a stronger, more productive sales program and in stimulating dealer cooperation. If your sales management group is interested in seeing this presentation, get in touch with*

The Hotpoint Committee on Cooperation with Utility Executives, Hotpoint, Inc., 5600 W. Taylor Street, Chicago 44, Illinois.

Hotpoint

(A GENERAL ELECTRIC AFFILIATE)

of electrical code books in case some of the boys had forgotten to bring them. To their surprise two-thirds of the fifty electricians asked for code books. According to state law, before a utility can connect a customer, the wireman must sign an affidavit that the wiring is completed according to code, yet most of these men did not have code books. As one old codger, with whiskers brushing his collar button, said, "I've always wanted one of these here books." Experience in other districts was found to be similar to Baraboo.

Through these refresher courses a large proportion of the wiremen, for the first time, gained a nodding acquaintance with the State Electrical Code which is similar to the National Code. The course also produced a substantial and continuing improvement in the quality and adequacy of wiring in this area.

Certified Adequate Wiring now is accepted by many electrical contractors, and some of them have really caught the spark of enthusiasm that gets best results. The first one hundred homes certified by the Central Wisconsin Adequate Wiring Bureau averaged 40 convenience outlets, 13 branch circuits and had 100-amp service entrances. The wiring refresher course paved the way for this acceptance.

The company's relations with the trade have improved to a noticeable degree as the wiremen have come to realize that power company interests lie very definitely in the same direction as their own.

• • •

COURT STREET is lighted to just under 5 ft-c with 21,000 lm mercury vapor lamps spaced on opposite sides of street on 65-ft centers

General Electric Photos

CLOSE SPACING, opposite on 65-ft centers, is shown in daylight view of Kankakee's Court Street. Mounting height is about 33 ft

Kankakee Claims Nation's Brightest-Lighted Street

COURT STREET (Kankakee, Ill.) with 7 ft-c at its main intersection, Schuyler Ave, and just under 5 along the street, claims to be the country's brightest lighted street, brighter than Chicago's State Street with just over 4 ft-c. For any community, and particularly one in the 50,000 population class, this is an outstanding accomplishment.

The Court Street installation is part of a new lighting system which covers an area of 23 blocks. Lighting is provided by 198 luminaires on modern aluminum ornamental standards. Mounting height is approximately 33 ft to the light center. Of the 198 luminaires, 80 use 21,000-lumen, and 118 use 16,000-lumen mercury vapor lamps.

Spacing on Court Street is 65 ft with units on opposite sides of the street. On the side streets, spacings vary according to conditions, some being 100 ft with units on opposite sides of the street, some 65 ft staggered and some 65 ft on one side of the street only.

Cost of the entire installation was $143,129.96 exclusive of engineering and attorney's fees.

The system is served by multiple circuits of 120/240 v, with lamps connected 120 v.

Consulting engineers on the job were Warren and Van Praag Inc, who originally designed the lighting for 300- and 500-w incandescent lamps on Court Street, which is 70 ft between curbs, and for 300-w lamps on side streets which are 40 and 52 ft between curbs. After visiting some outstanding street lighting installations, city officials decided upon mercury vapor lighting. Spacing of standards was not changed, but with the change in lamps, lighting intensities have turned out to be considerably above those originally planned.

Advantages of the new installation are improved safety conditions and better business. The new lighting brings people out.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Three 900-kvar equipments, three-connected and automatically switched in three steps in response to voltage level.

At the substation . . .

Outdoor pole-type capacitors extend all their advantages well out on a distribution line.

or on the line . . .

Make way for the Payload !

Capacitors provide the lowest-cost method of gaining extra circuit capacity . . . and now cost less than ever before . . . in some ratings as low as $3.60 per kvar. So, *now* is the time to make way for the payload . . . to release wasted circuit capacity for more kilowatts. And in the complete line of Westinghouse Inerteen Capacitors, you'll find the right equipment for the job.

From individual unit installations on primary distribution lines, to completely housed equipments for substation banks you can be *sure* of better performance with Westinghouse Capacitors—whether the application be power-factor correction, voltage control or reducing line and equipment losses. But, for any application, check first with Westinghouse.

Our years of close co-operation with utilities have given us broad experience in applying capacitors to many conditions. We'd like to apply it to your problem.

For complete information call your local Westinghouse office, or write for Booklet B-4343. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-60717

GET THESE TIME-PROVED FEATURES

- **Inertex Insulating Paper**
- **Inerteen Impregnation**
- **Solder-Sealed Porcelain Bushings**
- **Durable, All-Welded Steel Cases**
- **Weatherproof Zinc-Spray Finish**

Westinghouse

CAPACITORS

Chance tools are known for high quality. They are made of the finest practical materials and are expertly designed, on the basis of years of actual field experience, for maximum efficiency in use. You will save time and money on line construction jobs with tools that make the job easier—CHANCE Tools! Write for complete information today.

1. Installing bar, tamp, and anchor retriever in a single tool.

2. Pike pole with reversible safety point—reinforced butt—wire lift attachment.

3. Maul — seasoned hickory inserts prevent damage when driving anchor rods.

4. Telescoping trip auger — bores like a bit, adjusts for various hole sizes, has easy dump trip.

5. Anchor expanding and tamping bar. Will not slip off anchor top plate.

ABC INDUSTRIES

You know it's RIGHT when you specify CHANCE

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

INDUSTRIAL BRIEFS

Electric Furnaces Anneal Stainless Steel jet engine parts at the Solar Aircraft Co, San Diego, Cal. Two box-type ribbon resistor furnaces, each rated at 135 kw, operate with a protective atmosphere and are capable of annealing four turbo jet engine aft-frames at once, two to a furnace. Fabrication of these frames requires a carefully controlled annealing cycle to relieve stresses within the metal work. Protective atmosphere used is carbon dioxide, nitrogen, carbon monoxide and a small amount of hydrogen. Heat treating cycle is carefully controlled by special automatic program-type instrument controllers.

Electric Door System installed at the Beech Aircraft Corp, Wichita, Kansas for the large overhead double entry doors, saves materials handling truck drivers up to two hours of time daily. Drivers, without leaving their vehicles, can raise and lower both doors through a system of interlocking push buttons.

Higher Lighting Intensities up worker's efficiency, increase production and decrease spoilage at the Bachmann Uxbridge Worsted Corp, Uxbridge, Mass. When light intensities were increased from 14 to 70 ft-c, weaving efficiencies increased 10.5% and mending costs (spoilage) decreased 39.6%. In the final examining dept, when natural north daylight intensities, varying from 100 to 500 ft-c, were replaced by a stable fluorescent lighting intensity of 375-400 ft-c, a reduction of 10% in rejects resulted.

Induction Heating Cuts Costs and improves quality of piston rings at the Koppers Co, Baltimore, Md. Electric induction melting and centrifugal casting have almost entirely superseded the old method of cupola melting and sand melting at Koppers. Seven furnaces ranging in size from 200 to 375 kw have a total load of 2,000 kw. A 300 lb charge can be brought up to pouring temperature of 2,650 F in less than 30 min.—Industrial and Commercial Department of Gas Electric Light and Power Co of Baltimore.

Law library for piping fabricators

THE safety of your employees, the welfare of the community and a major investment can depend on a single piece of prefabricated piping. That's what piping codes are for . . . state, national, association and insurance codes. You don't have to know these codes because Grinnell engineers know the "law" intimately, check and cross-check with these codes at every step from preparation of detailed drawings and specifications right through bending, welding, stress relieving, heat treating, testing, final inspection, assembly and test runs.

That's just one of the many advantages of having a piping system prefabricated by Grinnell.

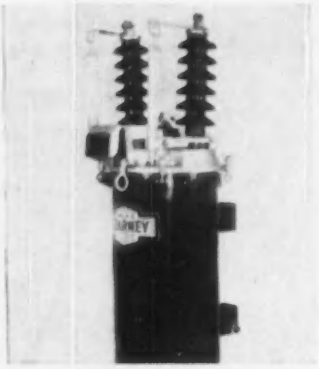
The complete "package" includes interpretative engineering, metallurgical research, compliance with code requirements, manufacturing drawings and specifications, production schedules, purchase of materials, specialized facilities, skilled personnel, control of quality and rigid inspection.

You get this complete package from a Grinnell prefabricated piping plant on schedule, ready for field erection, meeting all code requirements and at a real economy.

GRINNELL

Grinnell Company, Inc., Providence 1, R.I. Warehouses: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

NEW EQUIPMENT



Oil Circuit Recloser

RECLOSER PROTECTION for 24,950 GrdY/14,400-v rural systems has been made available in a new 25-kv oil circuit recloser. Although designed for the "experimental" REA voltage nominally rated at 25 kv, the OCR is applicable to any 1-ph circuit up to 15 kv. Larger bushings, greater oil capacity (8 gal) and increased internal electrical clearances are reported to provide the insulation needed.

Time-current characteristics of the 25-kv recloser are identical to those of 15-kv units. Two-coil operation, control of opening and reclosing times by a mechanical escapement, tripfree operating handle for picking up load, and other features are incorporated. There are two explusion arresters. Current ratings available are 5, 10, 15, 25, 35, and 50 amp.

James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

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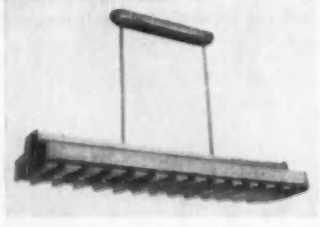

Commercial Luminaire

WHEN SUSPENSION MOUNTED, the new line of Type CC fluorescent luminaires for commercial applications have direct-indirect distribution; when surface mounted, distribution is semi-direct. A variety of types is available including the two or four-lamp units in 4-ft lengths, accommodating the 40-w lamp. The two or four-lamp units in 8-ft lengths use the 96-in. T-12 slimline operated at 425 ma.

Either metal or plastic sides may be selected, as may individual or continuous-row mounting, and two types of metal louvers. Company states that the surface mounting channel eliminates ceiling brackets and simplifies wiring.

Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

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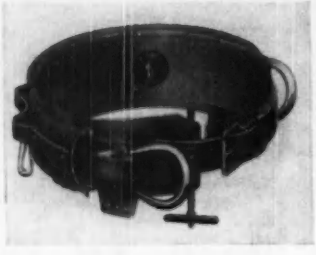


Lineman's Tool Belt

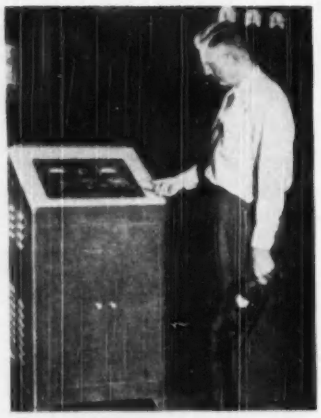
FREE MOVEMENT in either direction is said to be permitted by a new lineman's tool belt which has a full floating, sliding trace. Less chafing and reduced wear on the safety strap are also said to result from use of the sliding trace. Visual inspection of the sliding trace is possible throughout its length. The buckle and Dee rings are tested to 1,500 lb.

Mathias Klein & Sons, 3200 Belmont Ave, Chicago 18, Ill.

•

Ground Detector

LOCATING ELECTRICAL SYSTEM grounds is said to be greatly expedited with a detecting apparatus which functions while the circuits are "hot" and all equipment is running. Known as the Allen Ground Detector, the equipment includes a signal generator and a hand signal receiver similar to a clamp-on ammeter. Other accessories include a meter to register signal current, a test button to indicate ground intensity, a switch to control the impulse signal, and a pilot light. Control circuit for the automatic signal generator operates from a 115 v, 60-c receptacle.



Grounded phase is first detected by a voltmeter, with phase selector switch, on the signal generator control panel. A microammeter in the receiver picks up the low-voltage, pulsating signal current and gives a pulsating indication until the fault is reached. At the point of fault, where the signal current returns to ground, the microammeter needle remains stationary.

Excel Electric Service Co, 2127 S. Western Ave, Chicago 8, Ill.

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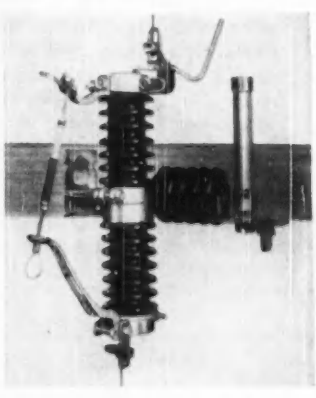
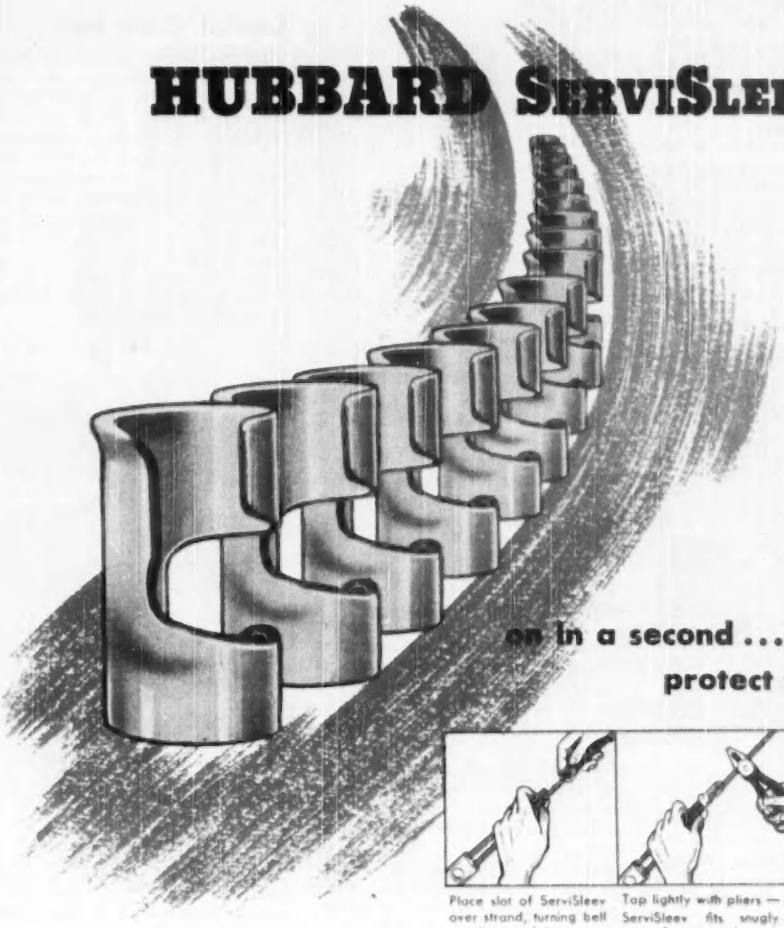


Lightning Protector

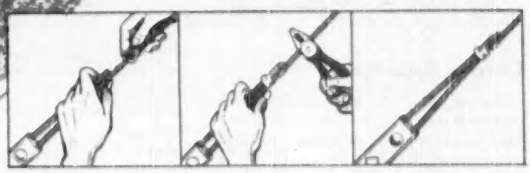
LIGHTNING, short circuit, and overload protection on rural lines is provided by the Protectogap-Protectolink combination. Grounding the expulsion gap assembly rather than the hanger

HUBBARD SERVISLEEVS



on in a second . . .

protect for life



Place slot of ServiSleev over strand, turning bell mouth toward clamp.

Tap lightly with pliers — ServiSleev fits snugly over free strand end.

The complete installation, strong, neat, and safe, is made in a few seconds.

Stock No.	Dimensions—Inches		Approx. Shipping Wt. Lbs., 100 Pcs.
	Strand Size	Overall Length	
7451	3/16	1¼	2.2
7452	¼	1⅜	3.4
7453	5/16	1½	5.5
7454	⅜	1¾	7.8
7455	7/16	2	11.0
7456	½	2¼	14.3

The ServiSleev is quickly slipped over the guy wire and the belled end turned toward the clamp. A few light taps with pliers or wrench drive it over the loose end of the strand.

The heavy galvanized steel retains its original shape and maintains a rigid grip on the guy strand. Design is such that the ServiSleev "rides" easily over the loose end of the strand. Hubbard ServiSleevs are easily installed, uniformly neat, and provide permanent protection.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

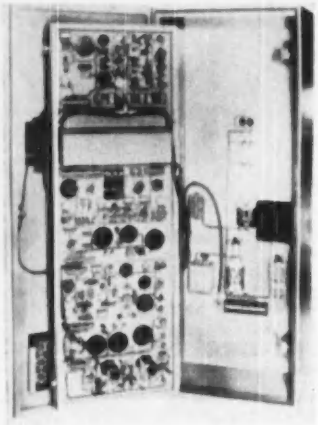
"Hang the Load on Hubbard Hardware!"

prevents birds or animals from shorting out the device. Manufacturer claims the explusion gap has high impulse values and is ahead of the fuse link, which reduces the number of fuse outages caused by lightning.

Ratings available are: 5 kv, 50 amp; 7.5 kv, 50 amp; 15 kv, 50 amp. Interrupting capacity of the Protectogap assembly is 8,000 surge amp—1,200 amp, 60-c follow current. They can be mounted directly on transformers.

W. N. Matthews Corp, 3850 Delor St, St. Louis 16, Mo.

•



Carrier Equipment

EITHER SINGLE or multiple frequency operation can be obtained with a new 25-w transmitter suitable for use over transmission lines having a total loss up to 55 db. The unit may be used for supervisory control, telemetering and communications.

When automatic operation of the transmitter is desired, the voice-operated relay will start transmission less than 10 milliseconds after speech has begun. Drop-off time is reported to be continuously variable from 30 to 300 milliseconds.

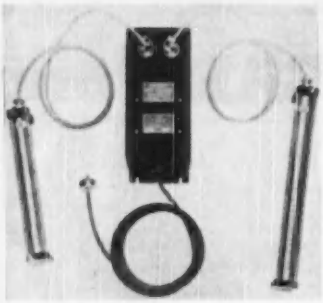
The equipment is adjustable by autotransformers for operation at line voltages from 100 to 130 v, 60 c, with line voltage surges of plus or minus 15%. Frequency range is 50 to 150 kc.

Control Corp, 718 Central Ave, Minneapolis 14, Minn.

•

Static Eliminator

PREVENTION of static-caused fires or explosions is said to be effected by the Takk static control. Applications include belt driven machinery, saw mills, cotton gins, and locations where highly volatile solvents are present. Control



of mild or intense static charges is reportedly retained at speeds in excess of 2,000 fpm. Personnel are claimed to be safe from shock even if in direct contact with the eliminator bar or power cable.

Eliminator bars may be supplied in any length from 1½ to 104 in., cables in lengths to 25 ft. The equipment consumes 15 w per bar.

The John Hewson Co, 106 Water St, New York 5, N. Y.

•

Manual Motor Starter

ESPECIALLY DESIGNED for controlling and protecting small motors used with fans, pumps, grinders, or stokers is a manual motor starter with positive bimetallic overload protection. Time delay for starting is provided by means of a front-removable heater of proper rating. The heater also allows motors to carry overloads up to their safe capacities before disconnecting them from the line.

Starter fits a standard 2½-in. wall box, has over-center toggle mechanism, and double-break contacts of silver. For surface mounting, the Motor Sentinel is available in an alloy enclosure.

Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

DISCONNECT SWITCH
"Bridge" assembly takes place of conventional braided shunt

SUSPENSION CLAMP
Can place aerial cable messenger above or below through bolt

BUS DUCT
Isolated phase construction for service to 15 kv, 5,000 amp

CONNECTORS
Each of 5 models is said to handle wide range of wire sizes

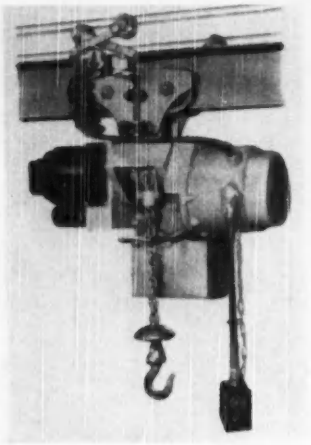
INDUCTION HEATER
Provides 10 kw for heat treating and fabrication operations

Conduit Cable Seal

SEVERAL LAYERS of Resistoyl rubber disks clamped between two metal plates by capscrews comprise the Type CS conduit seal. Holes are bored through the assembly to accommodate the required number of cables. Tightening the capscrews compresses the rubber disks against the conduit wall and cable to form a water and gas tight seal. They are available in a wide range of sizes, with steel or non-magnetic plates.

G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

•



Electric Hoist

LIFTING SPEEDS up to 41 fpm, both lower and upper limit stops, and a "pick-up" angle up to 30 deg from the vertical are three of the performance features claimed for the chain-type Load King electric hoist. Standard models lift loads through any height up to 40 ft and handle load capacities of 500, 1,000, and 1,500 lb.

The hoist's principal distinction is that link chain, over an electrically driven sheave, supports the load. This permits longer lifting lengths since wound-up chain does not wrap around a drum but collects in a metal container as the hook rises. Complete data appear in Bulletin P-1172.

The Yale & Towne Manufacturing Co, Philadelphia Div, Philadelphia 15, Pa.

•

Pump Protecting Unit

PREVENTION OF DAMAGE to pumps caused by their running without discharging water is claimed for a new control called Protectrol. It automatically stops the pump and delays start-

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

TRIPS.. **to protect**

DELAYS.. **to select**

the NEW DB Breaker Tripping Device

Here's a new overcurrent device that trips instantaneously on fault currents reaching a predetermined value . . . yet delays tripping on overcurrent caused by motor starting or other overloads of short duration. Also available—selective operation that causes only the breaker nearest a fault to trip. Breakers nearer the power source keep current flowing in unfaulted parts of the circuit.

This tripping device is the "mainspring" for the new Westinghouse DB Breaker—a breaker that's smaller, more dependable, more flexible, and has a longer life. Get top breaker performance, plus "one-unit" overcurrent protection, in your low-voltage system. Install the DB.

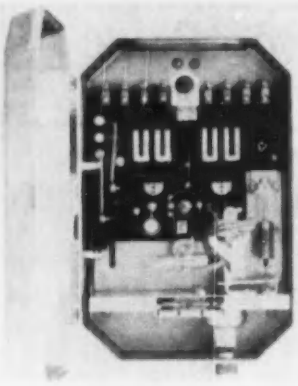
Here's the COMPLETE Story . . .

Get answers to your questions, plus complete information from the new DB Breaker Booklet. Ask your Westinghouse representative or distributor for B-4067. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60720

Westinghouse

"DE-ION" CIRCUIT BREAKERS

New Type DB



ing until manually reset.

An emergency condition causes the unit to energize an audible alarm circuit and light a warning lamp. Alarm silencer and automatic reset are included with the unit.

Automatic Control Co, 1005 University Ave, St. Paul, Minn.

•

Lighting Units

TWO-LAMP UNITS identical in design and appearance with the 4-lamp Mitchell Module lighting system have been introduced. Modules A-2, B, C-2, and D-2 use, respectively, two 14-w T-12 15 in. Type F lamps, one 32-w Circline lamp and one side prong spot lamp, two 40-w, T-12 48 in. Type F lamps, and 2 75-w T-12 425 ma slimline lamps. Complete information is in Bulletin 370.

Mitchell Manufacturing Co, 2525 Clybourn Ave, Chicago, Ill.

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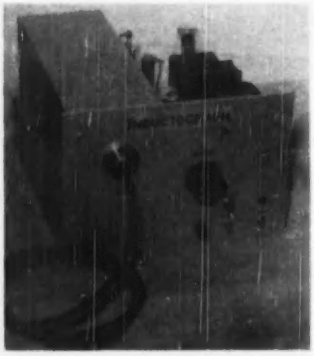


RF Power Supply

FROM 1 kv to 40 kv output, either negative or positive polarity, is reportedly produced by a new variable high voltage radio-frequency power supply, Model 99. Applications include insulation testing, precipitators, electrostatic painting, and research.

Voltage outputs on a low range from 1 kv to 12 kv or on a high range from 12 kv to 40 kv are selected with a switch. Output voltage is obtained from a radio frequency transformer and rectified by a half-wave voltage tripler rectifier system. Filament heater current at 6.3 v, or low voltage dc power for accessory electronic regulating or control equipment, may be used simultaneously with the high voltage output.

Inductograph Products, 236 W. 55th St, New York 19, N. Y.

•

Trouble Truck

CONVERSION of a half-ton standard panel delivery truck into an all-steel station wagon with all-wheel-drive is said by the company to result in a truck suitable for maintenance and trouble shooting. Seating capacity is seven persons, or 160 cu ft of cargo space is available when the seats are removed. Behind the front seat, floor length is over 95 in., width is 60 in., and height is 55 in. The four-wheel drive reportedly permits going through mud, sand and snow, and up steep grades.

Marmon-Herrington Co, Inc, 1511 W. Washington St, Indianapolis 7, Ind.

MORE NEW PRODUCTS
about which you should know

ASSOCIATED RESEARCH, INC, 3758 W. BELMONT AVE, CHICAGO 18, ILL., has announced Models 258A and 257A Vibropots for **earth resistivity** measurements. The instrument consists of a dc ohmmeter, an ac impedance bridge, and an instrument applicable for earth resistivity measurements by the four-point method. . . . THE MILLER CO, MERIDEN, CONN., offers the New Yorker fluorescent **luminaire**, furnishing direct-indirect light distribution for general commercial interiors; it is shielded 35 deg crosswise and lengthwise.

SQUARE D CO, DETROIT, MICH., has designed a line of narrow width NMOXX circuit breaker lighting **panelboards** to fit into the web of 8-in. wide-flange beams; 1-ph and 3-ph, 4-w services, 15 to 40 amp branch circuits. . . . AMERICAN ELECTRONEERING CO, 2112 S. LA BREA AVE, LOS ANGELES 16, CALIF., has developed Model PSR-100 regulated **power supply** unit for work with calculators, sound equipment, navigational devices.

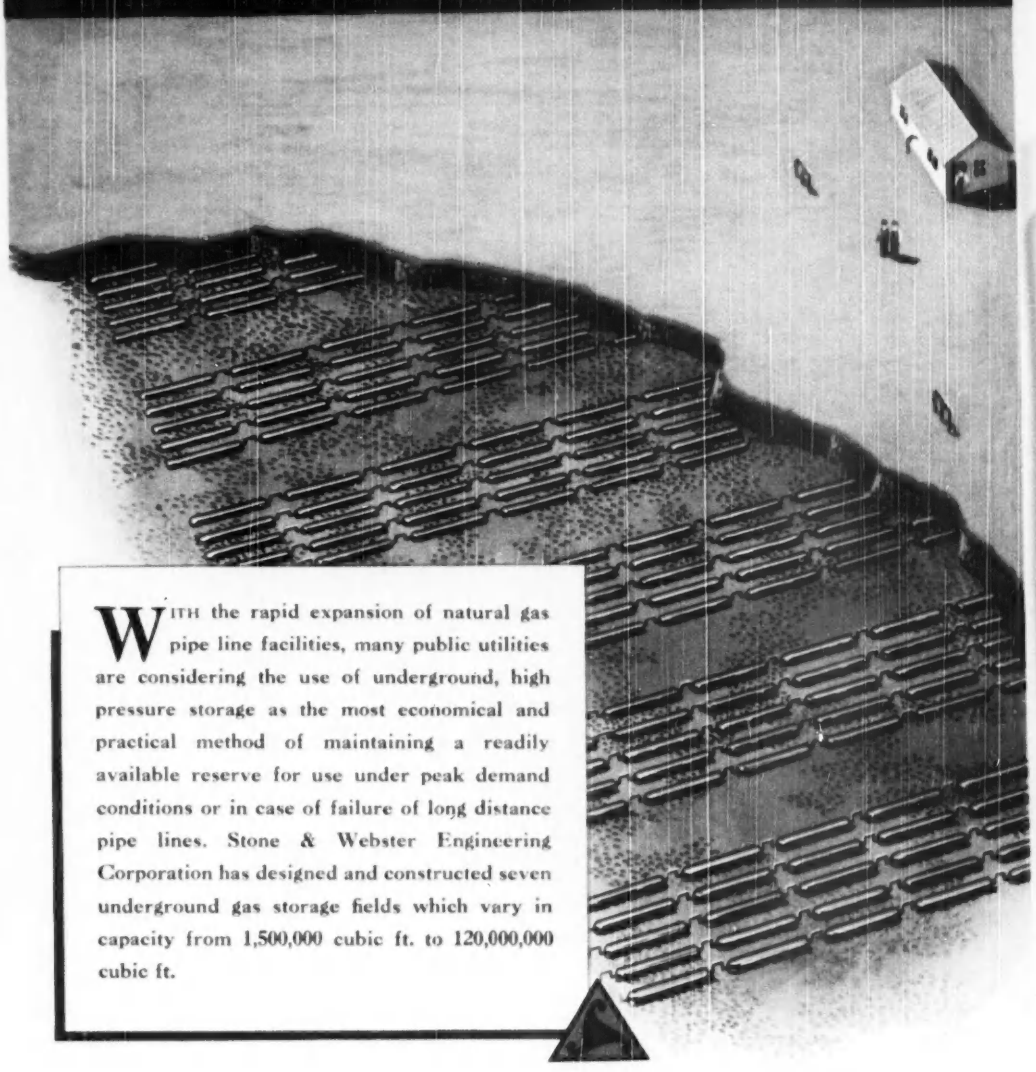
GENERAL ELECTRIC CO, SCHENECTADY 5, N. Y., is marketing a new calculating machine that can keep a continuous check on **reject rates** in production operations. Rise of rejects above a predetermined level is indicated. . . . GEORGE KOCK SONS, INC, EVANSVILLE 4, IND., is producing a front-loading **oven** for burning out motor windings preparatory to re-winding, or similar work.

VICKERS ELECTRIC DIV, 1815 LOCUST ST, ST. LOUIS 3, MO., has developed a self-saturating **magnetic amplifier** that may be used in operating control circuits, such as voltage regulators for small ac and dc generators, speed control for small dc motors, and controlled rectifier power supply. . . . LINCOLN PARK INDUSTRIES, INC, JAMESTOWN, N. Y., has a **trouble light** with a permanent Alnico V magnetic base permitting the light to be attached to a ferrous surface.

NEO-RAY PRODUCTS, INC, 314 E. 22ND ST, NEW YORK 10, N. Y., has introduced the Skylette fluorescent slimline **fixture** with removable ends. These reportedly permit continuous mounting and even lighting since there are no partitions at joints of troffers below reflectors. . . . SPEED SELECTOR, INC, 118 NOBLE COURT, CLEVELAND 13, OHIO, offers five new sizes of variable speed **combination sheaves** in load capacities to 7½ hp and speed changes as high as 7:1.

UNIVERSAL WINDING CO, PROVIDENCE, R. I., is making a manually-operated **coil winding machine** designed for production of paper-insulated coils in multiple or "stick" form. . . . EASTMAN KODAK CO, ROCHESTER 4, N. Y., has developed a **photo-sensitized cloth**, called Autopositive Cloth, for reproducing a positive copy directly from a positive original drawing.

From Nature's Gas Wells to Man Made Storage



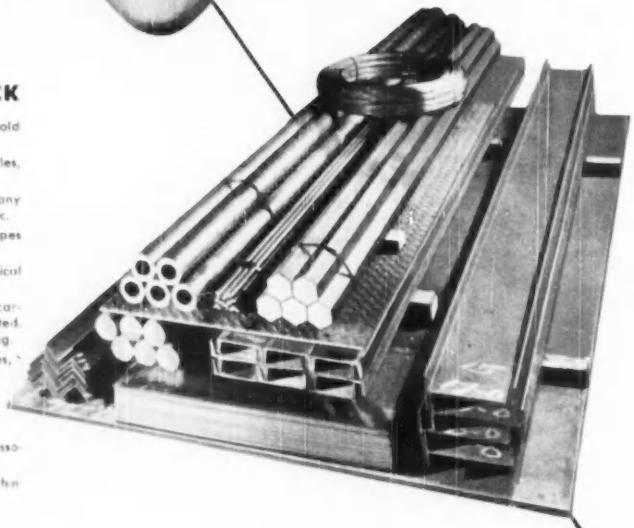
WITH the rapid expansion of natural gas pipe line facilities, many public utilities are considering the use of underground, high pressure storage as the most economical and practical method of maintaining a readily available reserve for use under peak demand conditions or in case of failure of long distance pipe lines. Stone & Webster Engineering Corporation has designed and constructed seven underground gas storage fields which vary in capacity from 1,500,000 cubic ft. to 120,000,000 cubic ft.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

Call us for steel

We ship quickly!



EVERY KIND IN STOCK

BARS, CARBON STEEL—Hot rolled and cold finished rounds, squares, hex's, etc.

STRUCTURAL SHAPES—Channels, angles, I and H beams, etc.

PLATES—Sheared, U. M. and mill edge, many types incl. abrasion resisting, E-Z-Cut, etc.

SHEETS—Hot and cold rolled, many types and coatings, cut to exact sizes.

TUBING—Seamless and welded mechanical and boiler tubes.

ALLOY STEEL—Low, medium and high carbon alloys, as-rolled, annealed, heat treated. Also tool steel, oil and water hardening.

STAINLESS STEEL—Allegheny bars, plates, sheets, tubing, pipe and fittings, etc.

INLAND 4-WAY SAFETY PLATE—For flooring, ramps, stair treads, product applications, etc.

REINFORCING STEEL—Bars and accessories, spirals, wire mesh, etc.

OTHER PRODUCTS—Babbitt metal, machinery and tools for metal fabrication.

RYERSON STEEL

RYERSON CERTIFIED STEELS

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI
CLEVELAND • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

NEWS ABOUT PEOPLE

West, Ahern Named Vice Presidents of NEES; Smith Heads Subsidiary

JOHN WEST

JOHN I. AHERN

Several executive changes have been made by New England Electric System with the departure on leave of absence of William Webster, executive vice-president, to become chairman of the Defense Department's Research and Development Board.

John West and John I. Ahern have been elected vice presidents. Alfred W. Smith will succeed West as president of Worcester County Electric Co, and Robert F. Krause has been appointed assistant to the president of NEES.

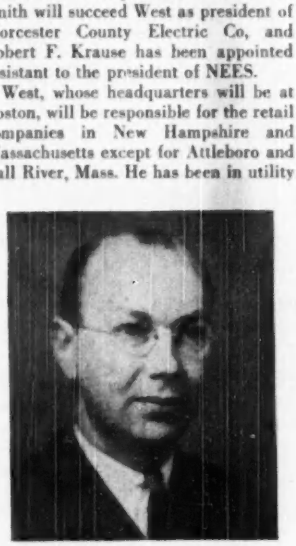
West, whose headquarters will be at Boston, will be responsible for the retail companies in New Hampshire and Massachusetts except for Attleboro and Fall River, Mass. He has been in utility work since 1907 and has been associated with NEES companies for nearly 40 years. His activities as a consulting engineer have included work in Europe, Central and South America, and the United States.

Smith is an assistant vice president of NEES. He joined the system group in 1925 and has specialized in financial phases of management during his 25 years there.

Ahern, who has been an assistant vice president, will continue to have his headquarters at Boston. He began with Weymouth (Mass.), Light & Power Co in 1930 and has been active in system public relations.

Krause is an attorney in the corporate department of New England Power Service Co.

Thomas G. Dignan, president of Narragansett Electric Co, Providence, will continue to be responsible for system property operation in Rhode Island and Connecticut and in Attleboro and Fall River.



ALFRED W. SMITH

•

S. P. Darlington has left Florida Power Corp to take a position as assistant to the vice president and general manager of Minute Maid Corp, Plymouth, Fla. Darlington during the war was with the Office of War Utilities' power supply section assigned to the Northwest. Previously he had been with Santee-Cooper.

EE Equipment Names Glover Sales Manager

H. A. Glover, sales administration manager of S&C Electric Co, Chicago, since last spring, has been appointed sales manager of Electrical Engineers Equipment Co, Melrose Park, Ill. R. T. Calloway, former sales manager, has been made sales promotion manager.

Before joining S&C as sales department supervisor in 1946, Glover was in the sales department of I-T-E Circuit Breaker Co, Philadelphia. Earlier he held engineering posts with West Penn Power Co, Duquesne Light Co, and Carnegie-Illinois Steel Corp. He is a member of the Association of Iron and Steel Engineers.

•

C. M. Turner, for the past three years in charge of the consulting service on rate matters given Cincinnati Gas & Electric Co by Ebasco Services, Inc, has joined the utility's rate department. He had been with Ebasco for 20 years. Turner is a member of the Load Research Committee of the Association of Edison Illuminating Companies and is vice chairman of the Electric Water Heating Committee of Edison Electric Institute.

Roger D. Ley has been appointed hydraulic engineer of Western Massachusetts Electric Co, Turner Falls. He succeeds **Herbert A. Moody,** retired. Ley joined the company in 1946 after some years of government work.

James G. Zeiler, assistant to the manager of the Marion-Muncie division of Indiana & Michigan Electric Co, Fort Wayne, has been named supervisor of industrial sales. **Robert M. Kopper,** supervisor of rates and tariffs for the South Bend division, has been appointed supervisor of rates and tariffs for the company, and **James M. Weaver,** safety director of the Marion-Muncie division, was chosen safety director.

Verne E. Dodson, assistant to the Pacific district manager at San Francisco, has been appointed district manager of engineering for the General Electric Co's Northwestern district at Seattle. He headed the industrial section for the company's San Francisco engineering division until July, 1948, when he be-

EISLER TRANSFORMERS

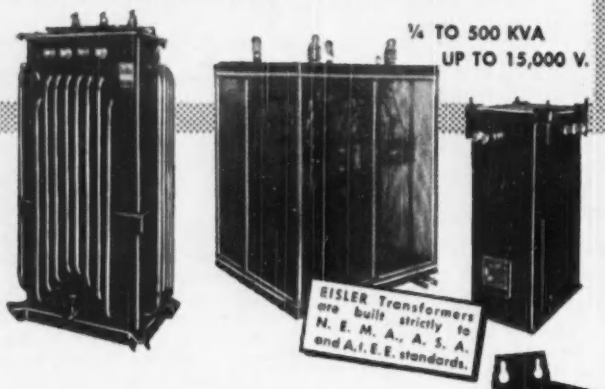
STANDARD • SPECIAL

AIR • OIL • WATER-COOLED

for

POWER DISTRIBUTION • LIGHTING • AUTO • ELECTRIC FURNACE • HEATING • PHASE CHANGING • WELDING • GENERAL PURPOSE

¼ TO 500 KVA
UP TO 15,000 V.

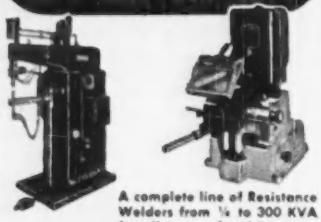


In addition to the manufacture of standard transformers the Eisler organization is especially well adapted to design and build transformers to the customer's specifications when departure from standard construction is desired. Send in your specification for quotations.

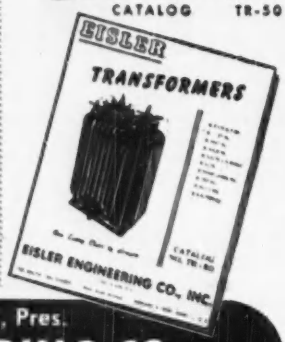
SEND FOR NEW CATALOG TR-50

EISLER RESISTANCE WELDERS

SPOT • BUTT • GUN • SEAM



A complete line of Resistance Welders from ¼ to 300 KVA for all types of welding.



CHAS. EISLER, Pres.

EISLER ENGINEERING CO. INC.

769 SOUTH 13th ST. NEWARK 3, N. J., U. S. A.

came assistant to the district manager. In 1942 he won the company's highest honor, the Coffin Award, for outstanding service in promoting electrical pumping equipment for agricultural purposes.

•

Copperweld Steel Picks 3 New Vice-Presidents

Paul Van Wagner has been appointed vice-president in charge of sales of Copperweld Steel Co, Glassport, Pa.

Other major appointments include William W. Ege, who will take over the

PAUL VAN WAGNER

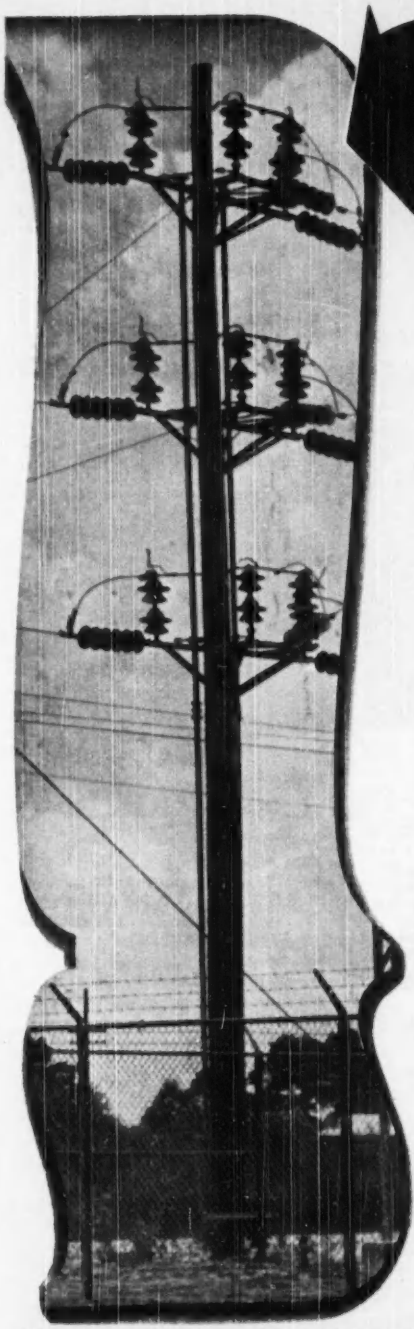
newly created post of vice-president and chief engineer, and P. A. Terrell, a new vice-president. F. E. Leib, transferred to the position of chief electrical engineer, will report to Ege. Henry

WILLIAM W. EGE

Oberle, who has been Copperweld's Eastern district sales manager, was appointed utility sales manager.

Van Wagner formerly directed Copperweld's export division, with headquarters in New York. Before that he was manager of sales covering the eastern part of the United States.

Ege has been vice-president in charge of sales since May, 1949. He also has



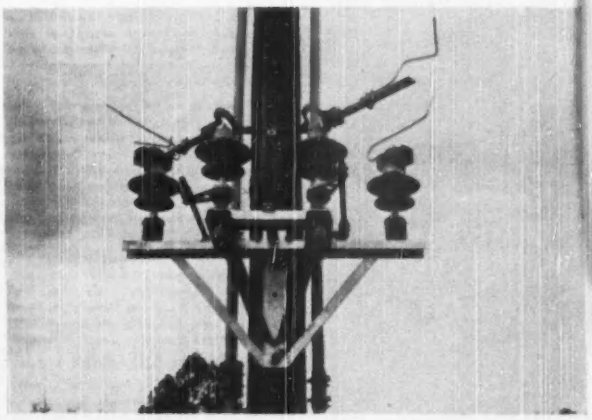
NEW MATTHEWS GOABS... cut switching station construction costs up to 47%

Revolutionary is the word for this new development in power transmission and distribution equipment! Its low installation and maintenance cost, as well as improved operating efficiency, will mean savings on your next switching station construction or renovation.

For example, here's how one Matthews GOABS 3 phase 69kv installation saved over $1700.00† of the cost of installing an old style switching system of the same capacity —

- ***It took 12 hours for job formerly requiring 72 to 80 hours — a terrific savings in labor costs!***
- ***Only one pole was needed where 6 were needed before.***
- ***One ground replaced 2 formerly required.***
- ***Only 54 — 10" suspension insulators needed — 90 were needed for old type switching.***
- ***Matthews GOABS needed only 9 strain clamps — 15 were necessary formerly.***
- ***Steel mounting, tee connectors and steel clamps were completely eliminated.***

In addition to these exceptional economy features, Matthews GOABS offer the greater safety of 180° of free climbing space and outstanding ease of conversion from a lower to a higher capacity switching system.



Write for Bulletin 601, for further information on the new, money-saving Matthews GOABS.
They are available in 600 Amperes — 15, 23, 34.5, 46 and 69kv ratings.

**Gang Operated Air Brake Switch.* *†Detailed figures available on request.*

W. N. MATTHEWS CORPORATION

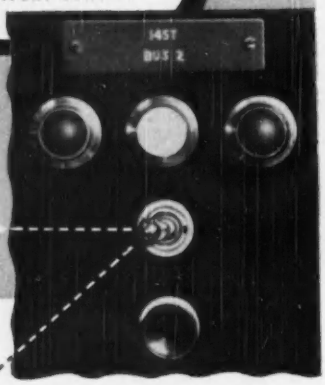
3844 DELOR STREET ST. LOUIS, MISSOURI

ENGINEERS and MANUFACTURERS SINCE 1899

put a 1-2 punch into your Power System

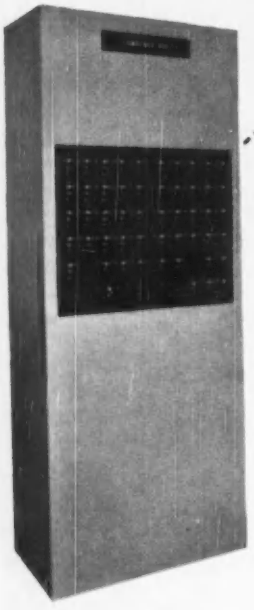
with SUPER-TROL

THE MODERN METHOD OF SUPERVISORY CONTROL



1 Select and Operate

2 See Proof of Operation



A typical Super-Trol Dispatcher's Cubical may be arranged for large or small power systems as required.

With SUPER-TROL just two simple operations provide continuous control of your power system. Put yourself in the dispatcher's place for just a minute. See how simple and reliable SUPER-TROL really is:

- First—you select the operation desired. You may want to open or close a breaker . . . start or stop a remote generator . . . do special telemetering. As you move the selector toggle switch a white light appears. This shows that a change is contemplated. Now you push the operating button. Immediately the frequency signals go out over the remote control circuit and SUPER-TROL goes into action.
- Second—you see positive proof of the completed operation. The white light is out. Colored lights immediately show that the desired operation has been completed. There are no false operations. No guesswork. SUPER-TROL is always accurate . . . fast . . . reliable.

CONSTANT AUTOMATIC SUPERVISION

The SUPER-TROL dispatcher always knows the exact condition of all equipment . . . what breakers are open or closed and where. Indications can be in the form of an electrical map which gives a constant overall picture of your system. If protective equipment opens a breaker, the dispatcher receives both an audible alarm and a visible signal.

Write today for engineering recommendations for your system

served as Western district sales manager and general manager of sales.

In his new post Terrell will be responsible for federal government activities. He worked for General Electric Co, Alabama Power Co, and Mississippi Power Co before joining Copperweld in 1928. For Copperweld he directed central stations and railroad sales and managed the Southern district before being named assistant to the executive vice-president.

•

Barney New President of Connecticut Power Co

Austin D. Barney, president and director of Hartford Electric Light Co and chairman of the board of Connecticut Power Co, has been elected president of the latter company. He succeeds Allan D. Colvin, who died March 11.

AUSTIN D. BARNEY

Barney, a graduate of Yale Law School, became a counsel for the Hartford company in 1924 and was made general counsel in 1928. In 1936 he was named vice president, in 1944 a director, and in 1946 president. He also has served as general counsel for Connecticut Power.

Barney's family has been associated with Hartford Electric Light for three generations. His father was an officer of the company, and his grandfather, the late Austin D. Dunham, was its first president.

Vice president and director of the D. N. Barney Co, Barney also is a director of Edison Electric Institute and of a number of insurance and industrial companies.

•

Charles E. Michel, vice-president of Union Electric Co of Missouri, has retired after 13 years with the utility. He will remain as a director and will act as a consultant on executive problems. Michel joined Union Electric in 1907 as manager of the automobile

ROCKBESTOS A.V.C.® CARRIES 32% GREATER LOAD

YET BOTH ARE THE SAME SIZE

*Compare A.V.C. with Type RH in a 250 MCM size**

Size for size A.V.C. has a HIGHER AMPERE RATING

Hi

YOUR BEST BUY

- you use 2½" conduit for both
- you use the same size fittings and lugs
- you have the same installation costs
- BUT Type RH carries only 224 amperes whereas higher-rated A.V.C. carries 296 amperes—a 32% increase in capacity.

For more efficient current-carrying capacity, always specify Rockbestos A.V.C. Write for the booklet "Cut Current Carrying Costs."

*From Chapter X—National Electrical Code—3 conductors in conduit—40°C-104°F.

ROCKBESTOS A.V.C.

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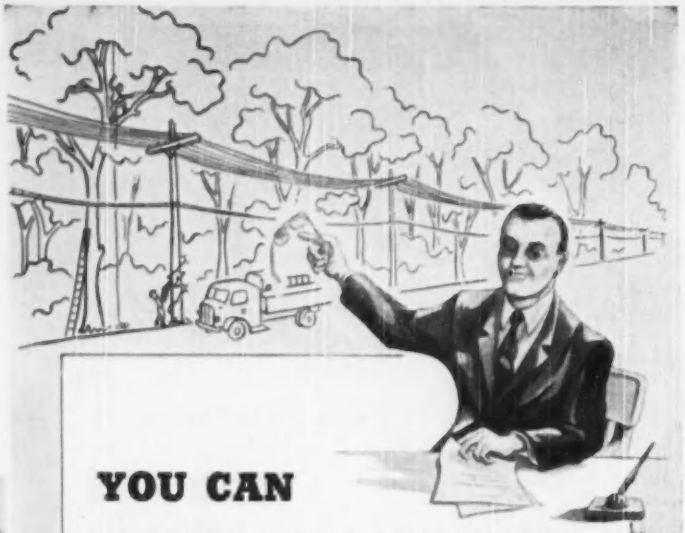
NEW YORK CLEVELAND DETROIT CHICAGO PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.



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department. He became sales manager in 1918 and vice-president in charge of sales in 1935. A former president of the St. Louis Electrical Board of Trade and the Missouri Association of Public Utilities, he won the James H. McGraw Award Medal for Cooperation in 1933 for his leadership in coordinating development of the electric market in St. Louis.

•

New Assignments

W. F. Munnikhuysen, vice president and general manager of the wood preserving division of Koppers Co, Pittsburgh, has been made executive vice president of the company. He spent 14 years in the construction business before becoming vice president of Connecticut Coke Co, then aligned with Koppers interests, in 1930 . . . **Howard A. Frey** has been appointed assistant manager of the engineering department of Locke, Inc, Baltimore. He will be responsible for all engineering matters. Frey has been with Locke since 1926 . . . **Herman A. Peterson,** division substation superintendent at St. Petersburg for Florida Power Corp, has been promoted to system substation superintendent. He joined the company in 1928.

•

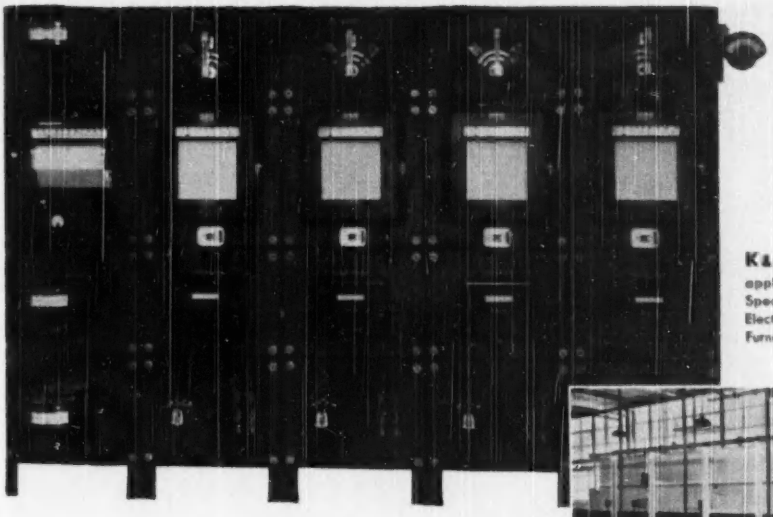
Walter H. Sammis, president and director of Ohio Edison Co and a trustee of Columbia University, has been made chairman of the national committee for the university's school of engineering.

OBITUARY

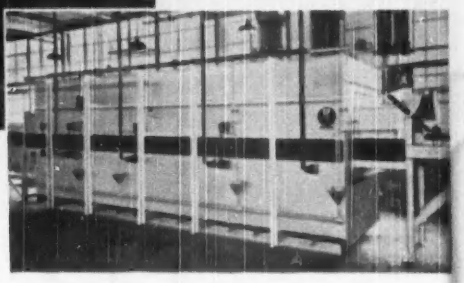
Gustav O. Wilms, 69, retired chief engineer of Allen-Bradley Co, Milwaukee, died March 13 at his home in Sarasota, Fla. He had been retired for several years after a long tenure as chief engineer. A native of Germany and trained in Hamburg, Wilms came to this country at the age of 21. He pioneered a number of developments in the electric control field, chief among them the modern solenoid switch.

John B. Moss, 82, retired vice president and general manager of Kennecott Wire & Cable Co, East Providence, R. I., died at Providence, March 17. He was at one time assistant district manager of American Steel & Wire Co, Worcester, Mass. From 1927 until his retirement in 1946 he was manager of the East Providence company.

William A. Kienzle, 66, controller of of Staten Island Edison Co from 1929 until his retirement last year, died March 29 at his home on Staten Island, N. Y., after an illness of several months.



K&M EBONIZED ASBESTOS
applied to control mountings of the Special Atmosphere Roller Hearth Type Electric Furnace, made by The Electric Furnace Company, Salem, Ohio.



K&M EBONIZED ASBESTOS
FOR SAFE MOUNTINGS THAT STAY PUT

The Electric Furnace Company's Special Atmosphere Roller Hearth Type Furnace is modern high-efficiency equipment. Control panels must live up to the same standard. Therefore K&M Ebonized Asbestos was adopted. This advanced K&M electrical mounting material combines unusual dielectric strength, mechanical strength, compactness and shipshape finished appearance. These values endure because K&M Ebonized Asbestos resists shock, vibration and temperature effects.

In addition to lasting serviceability, K&M Ebonized Asbestos means simplified production and assembly. Time savings result from the easy handling and cutting; the quick, clean machining and drilling.

The all-around utility of K&M Ebonized Asbestos is based on the proved K&M composition of asbestos fiber and binding cement—pressure-molded to high density, and impregnated with special insulating compound. Thicknesses from $\frac{1}{8}$" to 4" are available, so that engineers and designers are readily able to make a wide range of applications—switchboard mountings—bus bar runs—compartment linings—test tables, bench boards and the like. Full details regarding any uses will be promptly sent on request. Write us.

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Keasbey & Mattison has made it serve mankind since 1873

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Johns-Manville Announces Two New

Smooth layers of Quinterra Type 6 Electrical Insulation (Twin-ply), used in winding a Marcus dry-type transformer

Quinterra

TYPE 6 (TWIN-PLY)

A new cost-reducing, high-temperature insulation that prolongs transformer life many times through its resistance to pyrolysis

Here is a radically new asbestos-base, continuous-sheet, paper-like electrical insulation that offers many economies. It is primarily intended for interlayer and wrapper insulation in windings and coils used in Class A and B transformers (internal hot-spot temperatures 150C, or higher if special varnishes are employed).

Quinterra Type 6 is plied at the factory by welding two layers of Quinterra and calendering them into a dense, strong and smooth-surfaced insulation having good tensile and bursting strengths. For economical application with a minimum of waste, Quinterra Type 6 is furnished in continuous rolls cut to exact widths.

Excellent handling properties

Uniformity of physical and handling properties enables assemblers to achieve production rates such as are attained with the best types of interlayer and wrapper insulations. Further economies result from the large square-foot-per-dollar coverage.

Excellent constructional advantages

The plied construction of Quinterra Type 6 offers two distinct constructional advantages: (1) It provides better dielectric protection than a single layer. (2) Under stress, the weaving strains within coil structures are less likely to damage a plied insulation than a single-layer insulation.

Excellent dielectric-thermal characteristics

The base sheets of all Quinterra products are made 100% inorganic, but, for mechanical reasons only, are saturated with an organic resin. At room temperature (ASTM conditions) Quinterra Type 6 averages in excess of 550 VPM. After prolonged exposure at 175C, long after the thermoplastic saturant is driven off, it still maintains its original dielectric strength and requires only the re-establishment of its varnish protection to provide a further useful life cycle.

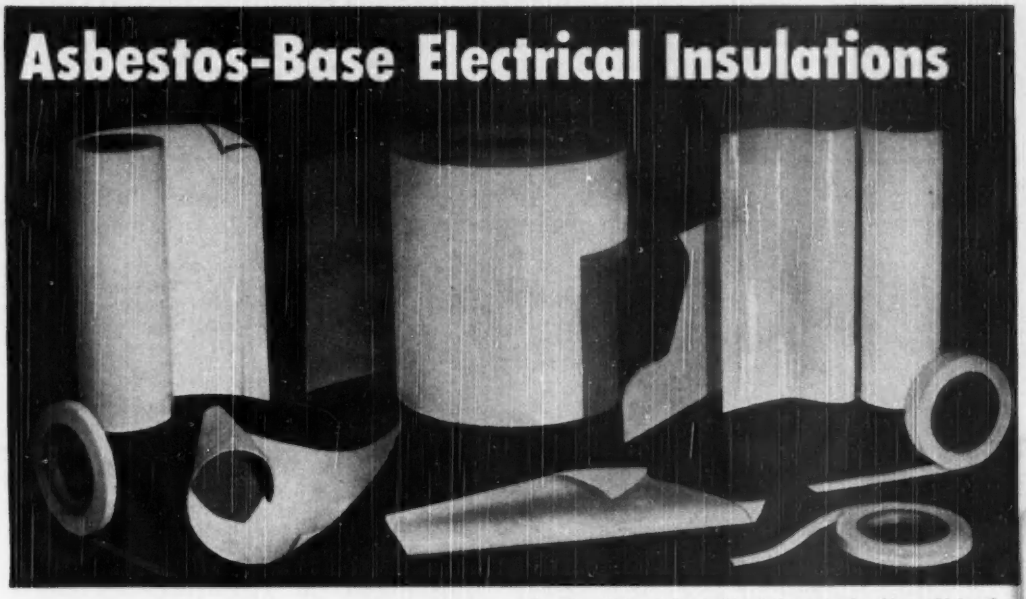
We will be glad to provide you with samples and further information about Quinterra Type 6 Electrical Insulation. Write Johns-Manville, Box 290, New York 16, N. Y.

Weights and thicknesses of Quinterra Type 6

Thickness ± 10%	Weight Per 100 sq ft ± 15%	Approx Coverage sq ft lb
.0045"	2.5	40
.006"	3.3	33
.007"	3.8	26
.008"	4.5	22
.009"	4.8	20
.010"	5.5	18
.012"	6.2	16
.015"	7.2	14

Johns-Manville

Asbestos-Base Electrical Insulations



A variety of types of electrical insulations as produced by combining glass, mica, and organic papers and films with Quinorgo #3000 or #4000.

Quinorgo

#3000 AND #4000

New, economical, high-temperature insulations with a previously unattainable combination of dielectric and mechanical properties

Quinorgo #3000 and Quinorgo #4000 are two new insulations developed by Johns-Manville. Each can be used alone or in combination with other dielectrics. In the latter use they can be either treated or coated with insulating varnishes, or combined with organic or inorganic electrical insulating sheets or films.

Quinorgo insulations contain 80% or more of specially processed asbestos fiber, the remainder being selected organic fibers and binders. The two types differ in that the organic portion of Quinorgo #4000 contains a small amount (3% or less) of resin not present in Quinorgo #3000. The resin slightly reduces absorption and penetration.

These highly improved forms of asbestos electrical insulations have extreme uniformity of texture and caliper (from .005" to .015"). They are furnished in continuous rolls, in tapes of exact widths and in sheets cut to size.

Excellent for compactness — Quinorgo #3000 and #4000 have important advantages where asbestos papers previously could not be used because they were too thick, their dielectric too low, or strength inadequate.

Excellent for "composites" — Quinorgo #4000, because of its heat resistance, closed nonwoven structure, uniform thickness and special penetration characteristics, is ideal for use in composite insulations.

For example, it may be coated on one surface with shellac or varnish to permit bonding or cementing to it such mechanically or dielectrically stronger materials as inorganic woven cloths and mica or organic cellulose films or sheets. The opposite surface remains ready for absorption of treating varnishes used in the further processing of equipment after the composite insulation has been applied.

Excellent for economies—Quinorgo #3000 and #4000 may be economically substituted for quality grade organic or inorganic layer insulation. When varnish-protected in apparatus, they will perform indefinitely because of their high asbestos content. (Hot-spot temperatures to 150C).

We will be glad to provide you with samples and further information about Quinorgo insulations. Write Johns-Manville, Box 290, New York 16, N. Y.

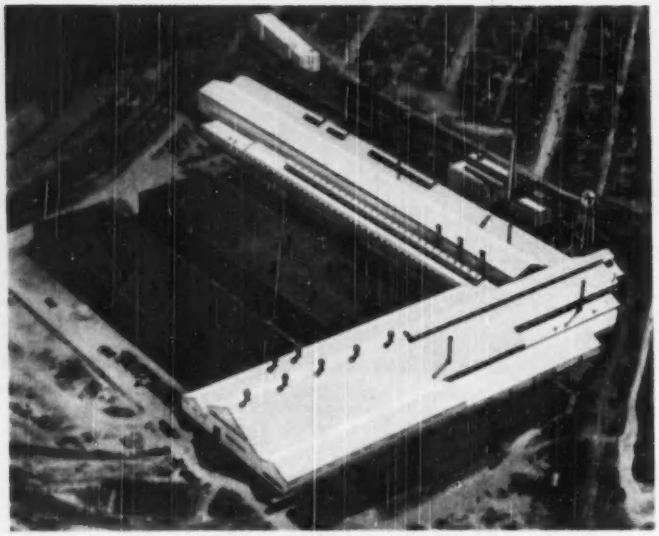
General average properties of Quinorgo #3000 and #4000

Thickness	Lbs Per 100 sq ft	1" wide Longitudinal T.S. lbs	Dielec Min VPM
	3000-4000	3000-4000	3000-4000
.005"	1.5 1.7	14 15	300
.007"	2.2 2.5	18 19	300
.010"	3.3 4.0	20 21	250
.015"	4.7 5.7	26 28	200

Electrical Insulations

JOHNS-MANVILLE JM PRODUCTS

MANUFACTURERS and MARKETS



PENNSYLVANIA TRANSFORMER CO now owns the plant it has been operating at Canonsburg, Pa. The company has bought from General Services Administration, War Assets, the land, buildings, and water supply it formerly leased from the government agency. Included are more than 21 factory buildings with a floor area of approximately 1 million sq ft, covering 216 acres, and containing a 50-million-gal water reservoir. The light-colored buildings shown in picture above are occupied by Penn Transformer; eight are leased to others

IUE Works Out Contract Demands to Present to Electrical Manufacturers

Contract demands to be presented to four major electrical equipment and appliance manufacturers were worked out at a three-day meeting of the new International Union of Electrical Workers, CIO, last weekend.

They are a non-contributory $125-a-month pension, including federal social security; severance pay for workers discharged before retirement age; a non-contributory social insurance program, including life and accident insurance and sickness, hospital, and surgical benefits; and a "substantial" wage increase.

These basic demands were drafted by 50 delegates from IUE locals at plants of General Electric Co, Westinghouse Electric Corp, General Motors Corp (electrical division), and Sylvania Electric Products, Inc. A subcommittee was appointed to work out the details.

Additional demands prepared by IUE's Westinghouse conference board include a shorter work week with no loss in take-home pay; nine paid holidays each year plus four hours off with pay on national and state election days; one day's vacation for each month of service up to 10 months and then two weeks' vacation after 10 months' service and three weeks after 15 years; equalization between the work keysheets of hourly and salaried employees; and the establishment of a company-wide keysheet.

IUE still has to establish itself as bargaining agent at plants of GE, Westinghouse, and Sylvania, where it is engaged in jurisdictional disputes with the United Electrical Workers, which formerly represented these workers. In a National Labor Relations Board election Feb 28 IUE won the right to represent the 29,500 employees of General Motors' electrical division.

Beginning on April 27, 51 elections will be held at 40 Westinghouse plants in 19 states. Some 55,000 employees are involved. Five other unions besides IUE and UE will be on some of the ballots. They include IBEW-AFL, International Association of Machinists (Ind), one other AFL union, and two other independents.

Eleven elections will be in tentative units of professional and salaried clerical employees and skilled craftsmen. Where these groups will be placed will depend on the voting. If a craft group votes for UE and UE also wins the plantwide election, the craft group will be merged with the larger unit. If the craftsmen vote for a different union or no union they will remain separate from the plant union.

NRLB has not yet set dates for voting at the plants of General Electric and Sylvania. More than 100,000 employees will choose between IUE and UE at GE and about 15,000 workers at Sylvania.

Since the UE was expelled from CIO last November, General Motors has withheld payment of the dues checkoff because of conflicting claims for the money from UE and IUE. It forced UE to go to court to establish its claim to the money. On April 3 General Motors turned over $139,189 it had collected from employees for dues checkoff to the custody of the Federal District Court at Detroit for disposition when the UE suit is decided.

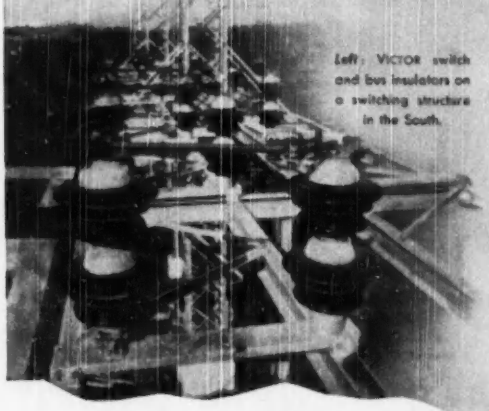
•

AEC 'Defers' Building of Atomic Power Plant

Construction of the atomic power reactor plant planned as part of General Electric Co's Knolls Atomic Power Laboratory has been "temporarily deferred" by the Atomic Energy Commission.

Two factors were responsible for the decision, said AEC, its desire for a "firmer cost estimate" on construction of the reactor and supporting facilities and the demands of the expanded

ANOTHER VICTOR INSULATOR THAT SAVES AS IT SERVES



Left: VICTOR switch and bus insulators on a switching structure in the South.

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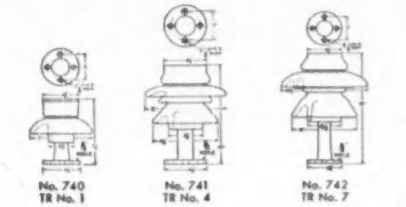
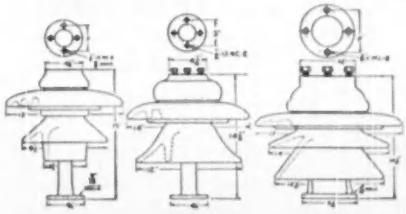


No. 740 TR No. 1 — No. 741 TR No. 4 — No. 742 TR No. 7



No. 744 TR No. 10 — No. 723 (2 unit stack) TR No. 16 — No. 729 (stacking unit) TR No. 140

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Guaranteed

BY

THE SUPERIOR ELECTRIC CO.

The Superior Electric Company packs into its voltage control equipment a wealth of research, design and production experience. Each unit is guaranteed to deliver — over normal periods of operation and life-expectancy — all the performance characteristics stated in Superior Electric advertising.

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Every STABILINE Automatic Voltage Regulator shipped from The Superior Electric Company has been inspected and tested to the most rigid mechanical and electrical specifications. It is your assurance that they will perform as advertised.

THESE ARE THE SUPERIOR ELECTRIC VOLTAGE REGULATORS

THE VARICELL *(above left)*

The latest Superior Electric development in voltage control equipment. Delivers DC voltage, variable from 0 to 30 volts, from an AC source. Output is stabilized — held to set values regardless of line variations. Output is regulated — unit automatically compensates for load fluctuations. Operates from any 95-135 volt, 60 cycle, single phase AC line. Stabilization and regulation are ±0.25% for output settings between 6 and 30 volts. R.M.S. ripple voltage does not exceed ±0.1 volts.

STABILINE TYPE IE *(above center)*

Completely electronic and instantaneous in operation. No moving parts. Maintains output voltage to within ±0.1 volts of nominal for line voltage variations; to within ±0.15 volts for any load current change — or for any load power factor change from 0.5 lagging to 0.9 leading. Waveform distortion *never* exceeds 3%. Available in a wide range of capacities.

STABILINE TYPE EM *(above right)*

Maintains constant voltage on heavily loaded lines. Features zero waveform distortion; complete insensitivity to magnitude and power factor of load; no effect on power factor; no critical adjustments; high efficiency; adjustable output voltage. Available for a wide range of applications in 115, 208, 230, 440 volt, single and three phase ratings; capacities to 100 KVA.

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THE SUPERIOR ELECTRIC CO.
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atomic energy production program, which requires "additional support" from the Knolls Lab.

The delay is considered to indicate increased emphasis on the hydrogen bomb as part of the "reorientation" of projects recently mentioned by Sumner Pike, acting AEC chairman. Design work on the reactor has been moving slowly because of demands made on Knolls by the Hanford, Wash., plutonium project.

Building of the intermediate power breeder plant at West Milton, N. Y., near Schenectady, had been scheduled to begin this spring. The nuclear reactor will be used for study of high-temperature operation and power production.

•

Copper Strike in Chile Threat to Price Level

Higher copper prices might result if the strike at Anaconda Copper Co's big Chilean mine stretches out indefinitely. However, prospects for settlement are considered bright.

All operations at the Chuquicamata, Chile, plant operated by Chile Exploration Co, Anaconda subsidiary, have been suspended for more than two weeks. Chilean authorities have intervened at the mine, largest in South America.

Workers at Anaconda's Raritan, N. J., refinery are back at work after four days of idleness following wildcat walkouts. Casting operations were suspended because the union, the Mechanics Educational Society of America, refused to agree to give 48 hours' advance notice of a strike. A complete shutdown at both plants would cut finished copper production by between 30,000 and 32,000 lb a month.

SALES ASSIGNMENTS

COMPANY STAFFS

Westinghouse Electric Corp, New England District, has formed Boston and Connecticut lamp sales divisions. I. W. Morrison is manager of the Boston unit, with offices at 10 High St. Fred R. West has been appointed Connecticut manager.

Allis-Chalmers Manufacturing Co, Milwaukee, has appointed Chester W. Schweers manager of the New England region with headquarters in Boston. Schweers, manager of the Los Angeles district since January, 1947, succeeds W. F. Taylor, resigned. Taylor and A. B. Frost, former manager of the Boston district, are establishing their own business.

REPRESENTATIVES

Electric Products Co, Cleveland, has appointed Sheldon Storer & Associates district representative for Kentucky and the southwestern section of Ohio.

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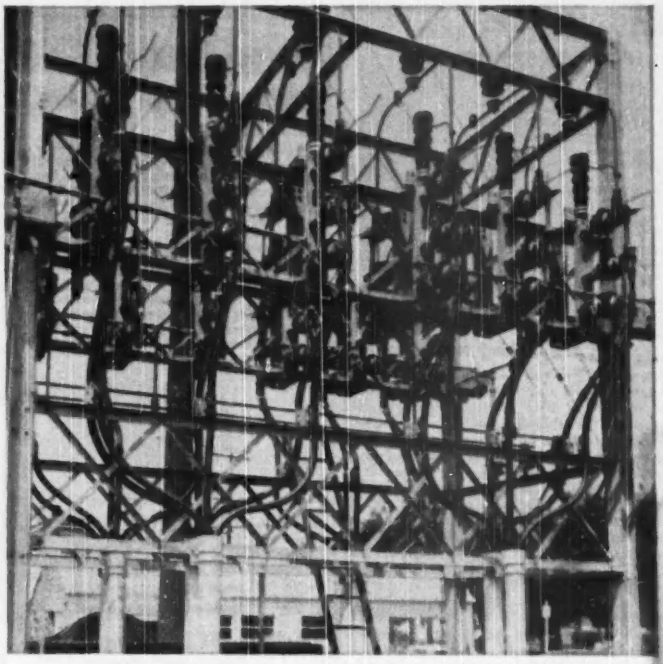

11,000 volt field cables spliced with plastic tape

Portland, Oregon power station protects splices against sun, snow and abrasion with "SCOTCH" No. 33 Electrical Tape

High-voltage cables get perfect insulation with "SCOTCH" No. 33 Electrical Tape at a new transformer station in Portland, Ore. Pacific Power & Light Co., owners of the station, report this dependable tape gives permanent protection—regardless of weather extremes, shock, or expansion and contraction of the 11,000 volt cables.

Whatever your insulating problem, this tough plastic tape can save you maintenance time and money. It's fast—goes on at a touch. Stretchy—conforms snugly to uneven surfaces. Write today to Dept. EW 450 for complete information.

TIP—for perfect high-heat insulation try "SCOTCH" Electrical Tape No. 27—Glass-backed, Thermo-setting Adhesive.

Made in U. S. A. by **MINNESOTA MINING & MFG. CO.**, St. Paul 6, Minn.

also makers of other "Scotch" Brand Pressure-Sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives.

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Secondary Capacitors

(*Continued from page* 101)

sidering the benefit to primary system. If light load power factor on primary system is too high, primary capacitors should be switched.

On some systems there may be diversity between system peak load and peak load on residential distribution transformers. Where such a condition exists, the demand values of the loss savings should be reduced by the square of the diversity.

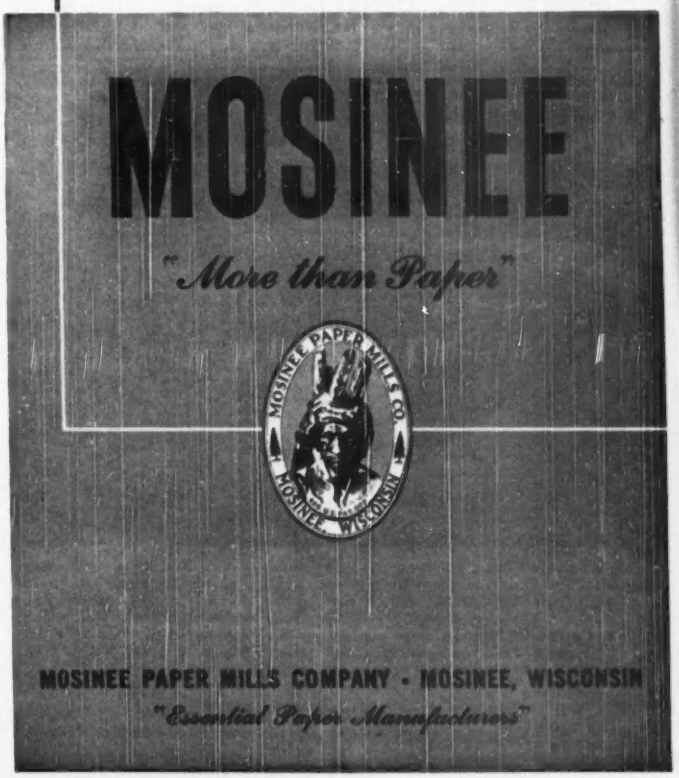
Case II . . . Consider now a second transformer in a somewhat lower class residential area. This transformer supplied 57 2-w and 3 3-wire services. Peak load was 26.7 kva at 78.5% power factor. Voltage drop on this transformer secondary is not too bad. The percentage drop in the transformer and secondary to the lowest point on the secondary is 6.85%. Figures 6 to 9 show conditions of this transformer secondary system before and after installation of 12 kvar of capacitors. Losses are calculated as in Case I and annual savings are summarized in Table III.

Here again the secondary capacitors are justified by comparing the capacitor cost. In this case it is $48 or (12 x ($11—7)) and the total annual saving is $23.75. In addition to the benefits indicated, the voltage rise provided by the capacitor is an important factor in this case as the maximum drop for the transformer and secondary is reduced to 5.04% at peak load. Re-arranging of the transformer secondary system will be postponed for a considerable time.

As shown in the accompanying picture, the secondary capacitors were installed at secondary level and were connected directly to the 240-v secondary conductors with No. 14 wire. No fuses or surge protection was used. The capacitor is inherently self-protecting for lightning surges and use of small wire will protect line from a fault in the capacitor.

Due to limited experience, little can now be said about the reliability of capacitor units. Some 25 units have been in service for two summers and additional 75 units for one summer with no failures to date.

In view of the experience gained to date Arkansas Power & Light Co plans the installation of more secondary capacitors where load and kvar requirements indicate the need.



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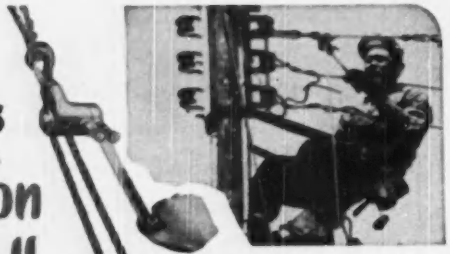

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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arkansas—Arkansas Power & Light Co., Simmons Natl. Bldg., Pine Bluff, transmission lines and substation and imprv. distr. sys. in Forrest City, St. Francis Co., **$314,000.**

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, **furnishing, del. f.o.b. cars** shipping point or f.o.b. cars Longmont, Colo., disconnecting fuse, fuse units, disconnecting switch for Leyner substation Colorado-Big Thompson Proj., Spec. 2962. L. N. McClellan, ch. engr.

Colo., Monte Vista—Public Service Co. of Colorado, 15 and Chapa Sts., Denver, substation, transmission line into city, and remodel local office, **$240,000.**

Florida and Georgia—Tri-County Electric Co-operative, Greenville, 394.6 mi. rural distr. lines and 10.1 mi. conversion in Madison, Jefferson, Taylor Counties, Fla., and Brooks Co., Ga. Plans deposit $10.

Illinois—Tri-County Electric Co-operative, Mt. Vernon, 97 mi. rural distr. lines and sys. imprvs., Jefferson Co., **$265,000.**

Ill., Waukegan—Public Service Co. of Northern Illinois, on Lake Michigan at Greenwood Ave., electric generating plant alterations, $3,000,000. **Sargent & Lundy,** 140 S. Dearborn St., Chicago, Zone 3, engrs.

Iowa—U. S. Eng., 1709 Jackson St., Omaha, Neb., installation power facilities for operation of flood gates on drainage Ditch 6, Inv. 159.

Ia., Denison—Bd. Trustee, Municipal Electric Light & Power Plant, Denison, Item 1, 1 rein.-con. cooling tower basin incl. piping, appurtenances, Lutz & May, 819 Finance Bldg., Kansas City, Mo., engrs.

Missouri—Southwestern Power Admin., P. O. Drawer 1614, Tulsa, Zone 1, Okla., 55 mi. 154 kv. rural distr. lines from Doniphan to Idalia, $175,000.

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point, or f.o.b. cars Louisville, 3 governors with pump. equip. for regulating speed of 21,500 hp., 150 rpm, vertical shaft, single-runner, Francis-type hydraulic turbines, Canyon Ferry Plant, Helena-Great Falls Div., Canyon Ferry unit, Missouri River Basin Proj., Spec. 2966.

N. C., Chapel Hill—University of North Carolina. C. E. Teague, asst. controller, Gerard Hall, power plant equip., electrical wiring and pipe work in 7 sections. Plans deposit $30. Wm. C. Olsen, 5 Exchange Pl., Raleigh, engr.

Oregon—U. S. Eng., Pittock Block, Portland, electrical distr. sys. and fire alarm sys. in government housing area of Lookout Point Reservoir, near Lowell, Lane Co., CIVENG 35-026-50-303.

South Carolina—Blue Ridge Electric Co-operative, Pickens, 100 mi. rural distr. lines and sys. imprvs., Oconee Co. **$350,000.**

Arkansas—U. S. Eng., 300 Broadway, Little Rock, Mar. 24, power house at Bull Shoals Dam, Cotter, from Wyche & Bruce Constr. Co., Grapevine, Tex., **$3,774,381.** Est. $4,771,395.

Calif., Los Angeles—City Dpt. Water & Power, 207 S. Broadway, two 21x32 ft., concrete electrical distribution stations. Owner builds, $90,000. S. B. Morris, c/o owner, engr.

Florida—Suwannee Valley Electric Co-operative, Live Oak, rural distr. line imprvs., extens., Suwanee Co. Owner builds. **$200,000.**

Minn., Mankato — Northern States Power Co., 15 S. Fifth St., Minneapolis, second unit 55x130 ft. steam electric generating plant, 80 ft. high, own forces, Approx. **$380,000.**

Montana—Bureau Reclamation, Dpt. Interior, Chester, Mar. 21, Spec. 2925, Fort Peck Proj. constr. 30,000 kvs. Havre substation, from Valley Eng. & Constr. Co., Grand Forks, N. D., **$87,587.** Est. $92,957.

Montana—Hill County Electric Co-operative, **Havre**, 449 mi. rural distr. lines, Hill, Blaine, Liberty and Chouteau Counties, from O'Neil Constr. Co., Havre. $526,952.

North Dakota—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., Transmission Div., Missouri River Basin Proj. Spec. 2813, Items 1, 3, 5, 7, 10, 13, 16, 19, 22 and 29, two 15,000 kva., two 10,000 kva., two 7500 kva., one 5,000 kva., and one 3,000 kva. transformers; two 15,00 kva. auto-transformers, with spare parts for Rugby, Devil's Lake, **Lakota, Carrington, Jamestown**, Valley City, Edgeley, Forman, Washburn, and Rolla sub-stations, to Mooloney Electric Co., 5290 Bircher St., St. Louis, Mo., $519,619***Items, 8, 11, 17, 20, 25, 27 and 30, five 1,500 kva. and two 2,000 kva. transformers with spare parts for Carrington, Edgeley, Jamestown, Forman, Leeds, Bisbee and Rolla sub-stations, to Larkin-Lectro Products Corp., Pin Bluffs, Ark., $72,318***Items 15 and 24, two 15,000 kva. auto-transformers with spare parts for Edgeley and Leeds substations, to Pennsylvania Transformer Co., 808 Ridge Ave., Pittsburgh, Pa., $70,977. Grand total $662,614. Bids 1/19, awarded 2/16.

Oregon—Central Electric Co-operative, Inc., Redmond, Mar. 24, 32 mi. rural distr. lines, in vicinity of Sisters and Prineville, Deschutes and Crook Counties, from Lebanon Electric Co., Lebanon. $155,788.

Washington—U. S. Eng., 4735 E. Marginal Way, Seattle, Zone 4, design, mfg. and delivery of first ten 100,000 hp. hydraulic turbines for Chief Joseph Dam, Bridgeport, Inv. 50-44, to Newport News Shipbuilding & Drydock Co., Newport News, Va., $6,220,300. Bids 2/10.

Washington—Douglas Co. Public Utility Dist. 1, Waterville, 10 mi. transmission line, 88 mi. distr. line, substation, Douglas Co., from Rockwell Monroe Line Constr. Co., Box 568, Bremerton, $160,666. W. S. McCrea, Perkins Bldg., Tacoma, engr.

Wis., Sheboygan—Wisconsin Power & Light Co., 122 W. Washington St., Madison, 7 story, 70x120 ft., steel, brick Edgewater Generating Plant addn., to Cunningham Bros., 359 E. Grand Ave., Beloit, $9,000,000. Bids 3/3.

Colorado—Holy Cross Electric Assoc., Glenwood Springs, system imprvs., Eagle Co. $195,000.

Tex., Lubbock—Texas Technological College, Lubbock, Mar. 18, electric and steam utilities extension on tunnel, general contract, from Standard Constr. Co., 1628 19 St., $49,700***electrical work from Empire Electric Co., 1015 W. Rosedale St., Forth Worth, $84,170***mechanical work, from Alford Plumbing Co., 2227 Cedar Crest Blvd., Dallas, $83,500.

Texas—Erath County Electric Co-operative Assoc., G. L. Martin, pres., Stephanville, Mar. 15, approx. 202.7 mi. rural distr. lines and converting approx. 57.2 mi. existing lines in Erath, Palo Pinto, Eastland, Hamilton, Comanche and Bosque Counties, from Mid-State Constr. Co., P. O. Box 7324, Dallas. $319,346. Est. $300,000.

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Proposed Construction

Ala., Birmingham—Barrett Div. Allied Chemical & Dye Corp., 40 Rector St., New York, N. Y., roofing mfg. plant, $2,000,000.

Del., Wilmington—Don A. Loftus & Assocs., 200 W. 9 St., shopping center development, department store, $15,000,000.

Ill., Chicago—Mt. Sinai Hospital, 2750 W. 15 St., Zone 8, 9 story, bsmnt. 65x175 ft. rein.-con., brick laboratory and service bldg., $1,500,000. A. Epstein & Sons Co., 2011 W. Pershing St., Zone 9, archts.

Mass., Worcester—City of Worcester Housing Auth., 22 Elm St., 600 unit housing, Home Farm Site, Approx. $6,000,000.

O., Granville—Denison University, Dr. Kenneth I. Brown, pres., Granville, hall of music and art on lower campus, incl. recital hall, 600 capacity auditorium, reception hall, etc. $1,000,000.

Low Bidders & Contracts Awarded

O., Oberlin—Bd. Trustees, Oberlin College, Oberlin, plans by Harrison & Abramowitz, Rockefeller Plaza, New York, N. Y., auditorium, N. Main St. $1,000,000.

Ia., Fort Madison—Sheaffer Pen Co., Fort Madison, plant addn., to The Austin Co., 16112 Euclid St., Cleveland, O. $2,500,000.

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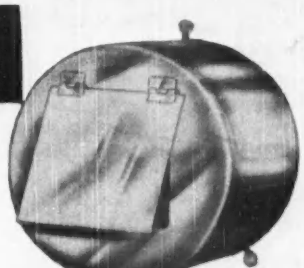

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WHAT ABOUT THE OTHER FELLOW?

But! What about the people who work for you? The man in the shop . . . your own secretary . . . the fellows in the shipping room. Do they know all this about the Census? Chances are some of them do, so the idea is to get the right information across to those who don't!

WHAT'S THE BEST WAY?

If it's possible, call everyone together and talk about it . . . ask questions . . . exchange ideas. If your outfit is too big for that, direct a Census information memorandum to all your employees. Post information on the bulletin boards. Run a Census story in the company house organ. Talk about it. *Every way you can . . . get the people who work for you to cooperate with the Census.*

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Better schools . . . school buses . . . school lunches. It means finer roads, bridges and highways . . . increased transportation facilities . . . improved safety regulations. It creates more efficient Public Service and furthers adequate distribution of utility services such as telephones, gas, water and electric power. It will help your community plan better parks, playgrounds, recreation areas and housing. It will mean higher living standards and accurate congressional representation. The Census is *everybody's voice in America's future!*

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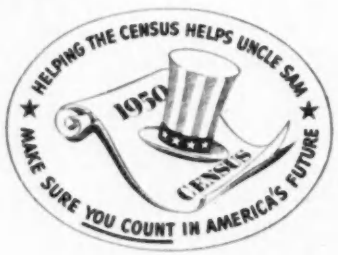

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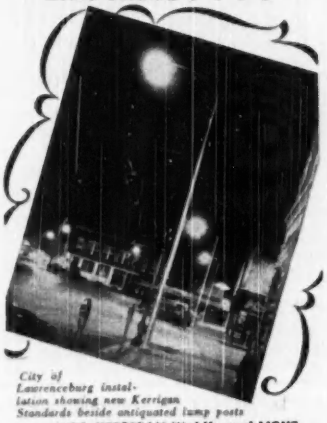

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N. J., Pleasantville—Goodwin Constr. Co., Barrington, apartment development, Delilah Rd., separate contracts, $2,000,000. Edward A. L. Cox, 709 Market St., Camden, archt.

Calif., North Long Beach—Lakewood Park Corp., 9434 Long Beach Blvd., South Gate, land imprvs. and 15,000 dwellings on 330 acre tract, own forces, $125,000,000. Southwest Drafting Service, 2724 W. Florence Blvd., Los Angeles, archts. Engineering Service Corp., 1127 W. Washington St., Los Angeles, engrs.

Mo., St. Louis—Ibec Housing Corp., 30 Rockefeller Plaza, New York, 20, N. Y., 1,000 to 2,500-family unit, poured concrete, Negro housing, Owner builds. $6,000,000-$15,000,000.

Wis., Kenosha—Nash Motors Div., Nash Kelvinator Corp., Kenosha, design and construction, 2nd story, 205,000 sq. ft. plant addn., to Austin Co., 16112 Euclid St., Cleveland, O., $5,000,000.

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Electrical World Reprints

Reprints of the 18 ELECTRICAL WORLD articles listed below are available in limited quantities upon request to ELECTRICAL WORLD, Editorial Offices, 330 W. 42nd St, New York 18, N. Y. Prices are indicated.

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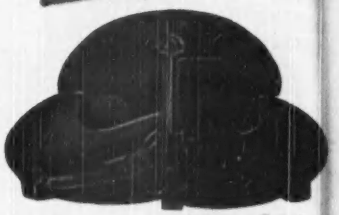

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UNIQUE INTERLOCKING DESIGN
Clamp automatically adjusts to fit all usual sizes of wire.

BOOK REVIEWS

A Measure for Greatness. By D. O. Woodbury. Published by McGraw-Hill Book Co, New York 18. 230 pages, illustrated. Price $4.

This is a biography of Edward Weston whose lasting fame rests on the refined instruments he devised to "measure the greatness" of electrical quantities. Many who know only that about him will be surprised to learn that he crowded into the 18 years before he embarked on that enterprise in 1888 a veritable lifetime of discouragements and defeats until he succeeded in making quantities of arc lamps and dynamos for the budding utilities. Prior to that he had had ups and downs in the plating business until he emerged as the recognized American expert in the field. He also created the first squirted carbon lamp filament. Indefatigable and persistent as his contemporary Edison in anything he undertook, he was similarly aggressive when he got embroiled in litigation that he came to enjoy, often for the sake of fight. Woodbury (also author of the Thomson biography *Beloved Scientist*) paints a candid picture of a searcher for perfection and precision who literally introverted himself out of society and family until in his retirement years he dashed to correct the deficiency. The inspiration, on the other hand, is there for any who today would relish seeing a revival of the era when devotion, persistence and determination were virtues.

Hydroelectric Handbook. By W. P. Creager and J. D. Justin. Published by John Wiley & Sons, Inc, New York. 1151 pages, illustrated. Price $12.50.

In this second edition the two authors of the first (1927) have enlisted the assistance of 18 collaborating specialists to bring the subject matter up to date. Their accumulation of 23 years of literature and personal consulting experience has been digested for incorporation in the four major sections. The first deals with rainfall, runoff, gaging, site investigation, basic hydraulics, comparative economics and hydro costs. The second treats the principles of design of the various kinds of dams and their construction and dependability. Section three pertains to the hydroelectric powerhouses and the means for getting the water into them and away. Equipment and plant operation is the subject matter of the final section, a good part of which will be familiar to electrical engineers, except the information on the hydro turbines and their auxiliaries. The electrical content pertains to the alternators, buses, transformers and transmission in condensed form. The type used is more like that in text books rather than the compact type commonly used in voluminous handbooks.

Elementary Pile Theory. By H. Soodak and E. C. Campbell. Published by John Wiley & Sons, Inc, New York 16. 73 pages, illustrated. Price $2.50.

The pile will undoubtedly be an adjunct of power plants realizing on neucleonic energy and most likely of the breeder variety. While this book makes no mention of the breed-function it does present the physics, mechanics and mathematics of the elementary pile. The dimensions of slowdown, diffusion, escape and reflection are determined leading to a critical volume value of an 18-ft cube. Pile control is also discussed in mathematical terms.

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CATALOGS • BULLETINS

● LUMINAIRES: A complete line of fluorescent and slimline commercial, industrial and residential luminaires is listed in a new catalog. Keystone Electric Manufacturing Co, 2228-36 E. Tioga St, Philadelphia 34, Pa.

● BLOWERS: Design and construction features and operating characteristics of R-C centrifugal blowers and exhausters appear in Bulletin 120-B-14. Roots-Connersville Blower Corp, 900 W. Mount St, Connersville, Ind.

● DITCHER: Features of the Model 306 utility ditcher, and its applications, are listed in an 8-page bulletin. Gar Wood Industries, Inc, Findlay Div, Findlay, Ohio.

● HARDWARE: Pole line hardware, power insulators and suspension hardware are listed in the 90 pages of the "RM Handylog". Locke, Inc, P. O. Box 57, Baltimore 3, Md.

● RECTIFIERS: Standard and high-voltage selenium rectifiers for power supplies and electronic circuits are described in Booklet DB-19-025. Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

● COMBUSTIBLES RECORDER: Drawings and photographs explain the operation of the combustibles recorder and offer applications to boiler furnaces, rotary kilns, industrial furnaces, etc. Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland, Ohio.

● AIR BREAK SWITCH: Gang operated air break switches for 15 to 69 kv, 3-ph, are described in Bulletin 601, together with suggestions for using them. W. N. Matthews Corp, 3850 Delor St, St. Louis 16, Mo.

● LIGHTING: A 40-page bulletin lists lighting data on the Sky-Glo luminous louvered systems and many types of industrial, commercial and outdoor lighting. Benjamin Electric Mfg Co, Des Plaines, Ill.

● TRANSMISSION: Details of the Zero-Max variable speed transmission are presented in Bulletin 149, in addition to information about selection of the proper motor sizes for use with the transmission. Revco, Inc, 405 Thorpe Bldg, Minneapolis, Minn.

● FLUID DRIVES: Fluid drive arrangements (reportedly permits motor to gain speed smoothly under low starting torque) for applications as high as 200 hp are shown in a 28-page catalog and engineering data book, No. 2385. Link-Belt Co, 307 N. Michigan Ave, Chicago 1, Ill.

● PORTABLE POWER OUTLETS: String-a-lite lines for portable light and power transmission are described in Bulletin SL202. Mines Equipment Co, 4235 Clayton Ave, St. Louis 10, Mo.

● LIGHT DIMMERS: "Powerstat Light Dimming Equipment for Schools" is an 8-page bulletin outlining the recommended uses of dimming units in school. Superior Electric Co, Bristol, Conn.

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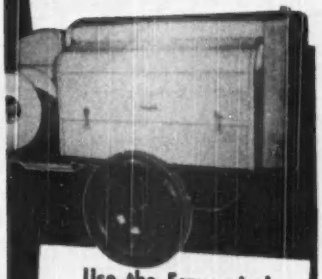

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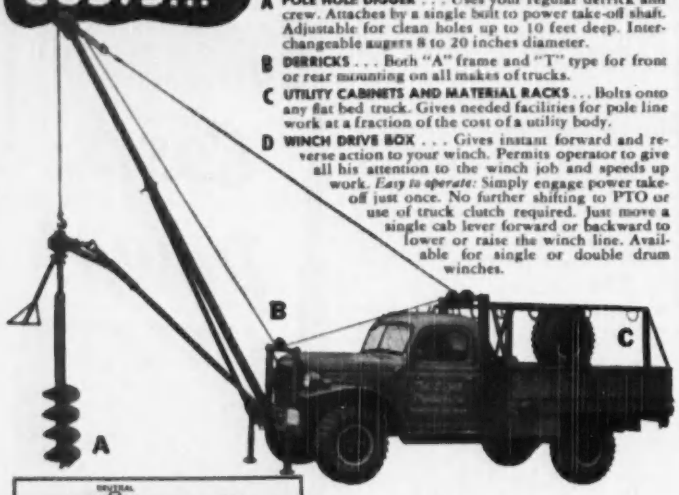

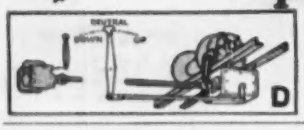

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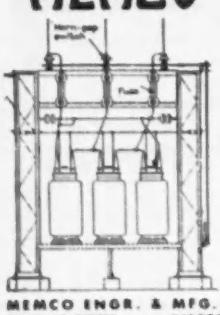

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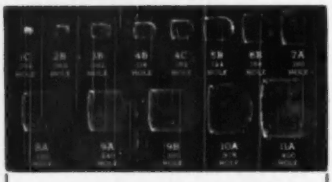

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LETTERS TO THE EDITOR

Request for Problems

To the Editor of ELECTRICAL WORLD:

I was pleased with the editorial "University Research" in the ELECTRICAL WORLD, January 30, 1950. Our graduate program in Electrical Engin ring has been expanded in the last few years. As you know, one of the requirements for the Master of Science degree is that the student present a thesis based upon a research project.

With a considerable number of graduate students, the selection of suitable problems for research becomes increasingly difficult. As you mentioned in the editorial, the "power course" electrical professor should have power researches. The easiest place to find a problem has been the machinery laboratory and for that reason the utility type problem has been neglected.

I would welcome problems in the utility field and as you put it, "to engage their professional interest and apply their graduate students." There are many advantages to such a procedure—to the utility, to the student, and to the professor.

Charles F. Cameron, P. E.
Professor of Electrical Engineering

Oklahoma Agricultural and
Mechanical College
Stillwater, Oklahoma

House Heating Needs Study

To the Editor of ELECTRICAL WORLD:

The interesting article by G. G. Freyder of the Commonwealth Edison Company in your January 16th issue and your editorial comments in the statistical issue are most valuable contributions to the study of electric heating. It is the conviction of this company that electric heating can be sold effectively with great customer satisfaction when the electricity can be supplied at 2¢ per kwhr or less.

The ability of the power industry to sell profitably electricity for heating purposes at 2¢ per kwhr is the kernel of the problem.

For effective study of this matter certain points have already been established:

1. Different types of electric heating systems produce different types of demand curves. . . .

2. It is essential that electrically heated homes be so constructed and insulated that they do not lose at a 70 deg temperature differential more than 4 Btu's per cubic foot of interior content. The planning economies made possible by

electric heating more than offset the cost of this extra insulation.

3. The structure should have built into it materials which give it a fly wheel or carryover effect to enhance the facility with which the critical '5-6' PM demand can be controlled.

4. The person who wants electric heat is an electrically minded person who is disposed to have as many electric appliances as possible; the electric range and controllable water heater go in almost automatically.

5. The radiant heating load is an interruptable or controllable load, for periods up to an hour and a half.

6. If the thermostat settings on radiant heating systems are not set down 10 deg-15 deg at night, the maximum demand occurs during the hours between 12 M and 7:00 AM.

7. In most areas during a year over 45% of the kwhr consumed are consumed between 11:30 PM and 7:00 AM and upwards of 60-65% between 9:00 PM and 8:00 AM. If the rate structure is so designed to encourage night consumption, and allows of high demand at non-critical periods, the quality and profitableness of the heating load characteristics is greatly increased.

8. Houses of same design situated in different parts of a town do not necessarily impose their peak demands for space heating at the same coincident of time.

It is the policy of this company to co-operate wholeheartedly with Utility companies in obtaining data which will help them in determining the cost-to-serve the "All Electric Home" which includes controllable radiant heating and controllable water heating.

Unfortunately, not very many utility companies have yet been able to install adequate metering and recording equipment and it is hoped that as soon as possible more houses will be fully measured so that the *yearly* characteristics of truly all-electric houses can be fully studied to see whether or not it is true that more kwhr per year can be sold at an average lower rate per kwhr with an improved trend in the net profit from the domestic customer, and to determine what degree of space heating saturation gives optimum return. . . .

The radiant heating load holds great profit possibilities for the utility which encourages controllable and therefore profitable load growth.

It is a great market and the public wants it. Since the public wants it, let us find a way to give it to them profitably, and devise rates to encourage filling the valleys in present day production and distribution system load curves.

Let the sights be set really high for 1960, not only in volume but in load-factor improvement.

Robert A. Archer-Shee

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New York, N. Y.

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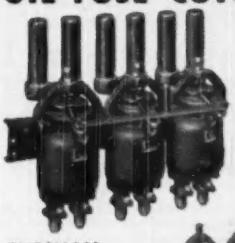

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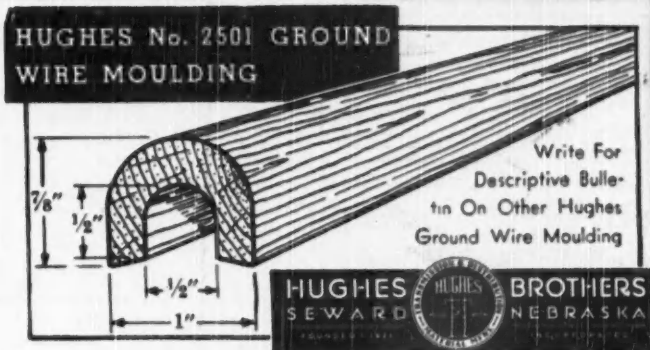

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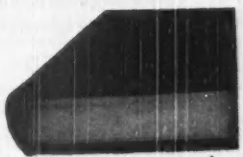

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TOP-NOTCH Executive to oversee construction program and later operate 35,000 KW generation and transmission system. The man we want must have proven management competence. Apply to A. J. Pew, President, East River Electric Power Cooperative, Inc., Millbank, South Dakota.

ELECTRICAL MECHANICAL Engineer with experience in the design of power relays and light duty switch gear. Excellent opportunity for right man with an established manufacturer. Location Indiana. P-6163, Electrical World.

GRADUATE ELECTRICAL Engineer who can write. Degree in journalism, or experience in that field, important factor, but not essential. First hand knowledge of rural electrification helpful. Must be under 30 years of age. Excellent opportunity. Write P-6208, Electrical World.

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UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. 2953) will be received by Bureau of Reclamation, Denver, Colorado, April 27, 1950, and then publicly opened for furnishing two 250-volt battery distribution boards; and three 460-volt power boards for units A-3, A-4, and A-9, Hoover Power Plant, Boulder Canyon Project, Arizona-California-Nevada. Delivery is desired within 300 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner.
(100)

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3— 200 KVA G-E	6900/11950Y-230/460
3— 200 KVA G-E	6600/11430Y-2300
3— 150 KVA G-E	22000-2300/4000Y
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KVA	Make	Type	Volts	Speed
6140	Whse		2400/4150	600
4000	G.E.	TSC	2400/4150	900
3000	Whse.		2400/4800	720

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3 ph. 60 cy.

KW	Make	Speed	DC Volts	AC Volts
1800	G.E.	600	115/230	2300/4150
1500	G.E.	360	275	2200/4400
1500	G.E.	600	600	2300/4150
1250	G.E.	600	275	4150
1000	Whse.	900	600	4150

TRANSFORMERS—60 Cycle

Kva	Make	Type	Ph.	Voltages
2046	Whse.	OISC	1	66000x11000
2500	Al. Ch.	OISC	3	13200x2300
2500	Pedi.	AT	3	13800x2300
1250	G.E.	HVDDJ	1	6900x550
1000	Pitts	OISC	1	13200x2300
600	Al. Ch.	OISC	3	2300/4150x220/440
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167	G.E.	HS	1	2400x240-480

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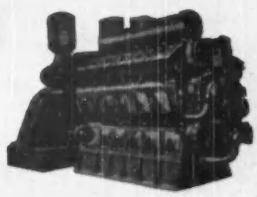

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1875	Fairbanks Morse	38F16	2000	300	375	Enterprise	DSG-6	450	450
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1250	General Motors	16-278A	1600	720	312	General Motors	3-268A	400	1200
937.5	General Motors	12-567	1000	750	312	Clark	6D-6	375	327
625	Alco	6-12⅛x12T	750	600	167	Ingersoll Rand	9	225	514
625	Baldwin	VO-6	510	450	125	General Motors	2-268A	150	1200
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2— 150 KW G.E. 125/250 V 1200 RPM 4150 Volt

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1—1500 KVA G.E. 3 Ph. 4150 V 2300 V Pyranol
1—1000 KVA G.E. 3 Ph. 4150 V 2400 V
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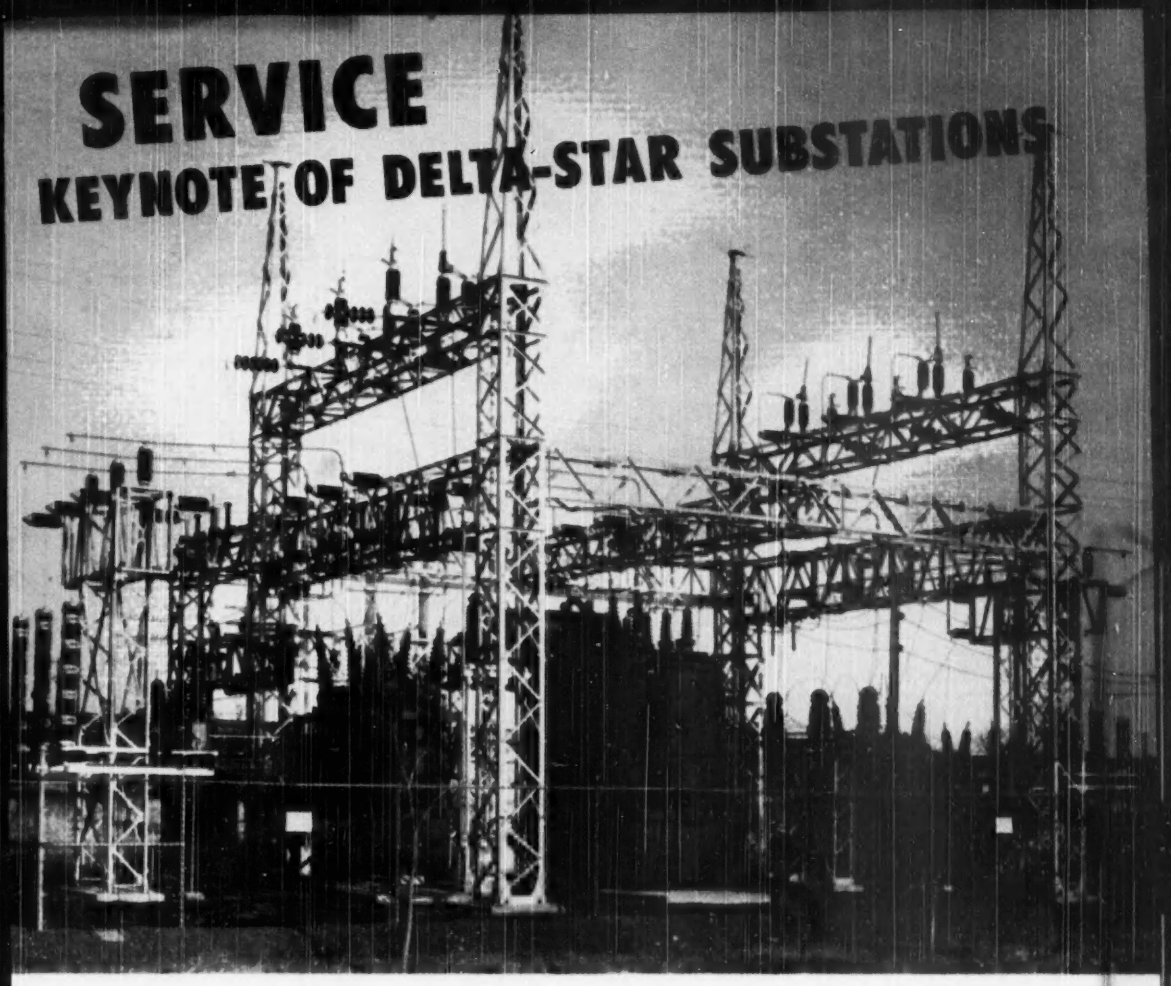
SERVICE
KEYNOTE OF DELTA-STAR SUBSTATIONS



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